COMPARISON OF TRACHEAL INTUBATION USING AIRTRAQ AND McCOY LARYNGOSCPE IN THE PRENSENCE OF RIGID CERVICAL COLLAR SIMUTATING CERVICAL IMMOBILISATION FOR TRAUMATIC CERVICAL SPINE INJURY

DISSERTATION SUBMITTED FOR THE DEGREE OF

DOCTOR OF MEDICINE

BRANCH – X (ANAESTHESIOLOGY)

APRIL 2015

THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY

CHENNAI

TAMILNADU

BONAFIDE CERTIFICATE

This is to certify that this dissertation entitled **"COMPARISON OF TRACHEAL INTUBATION USING AIRTRAQ AND McCOY LARYNGOSCOPE IN THE PRESENCE OF RIGID CERVICAL COLLAR SIMULATING CERVICAL IMMOBILISATION FOR TRAUMATIC CERVICAL SPINE INJURY "** is a bonafide record work done by **Dr. SATHEESH .P** under my direct supervision and guidance, submitted to the Tamil Nadu Dr. M.G.R. Medical University in partial fulfilment of University regulation for MD, Branch X - Anaesthesiology

PROF. Dr .S.C. GANESH PRABU, M.D, D.A,
Director,
Institute Of Anesthesiology,
Govt. Rajaji Hospital &
Madurai Medical College
Madurai.

CERTIFICATE FROM THE GUIDE

This is to certify that this dissertation entitled **"COMPARISON OF TRACHEAL INTUBATION USING AIRTRAQ AND McCOY LARYNGOSCOPE IN THE PRESENCE OF RIGID CERVICAL COLLAR SIMULATING CERVICAL IMMOBILISATION FOR TRAUMATIC CERVICAL SPINE INJURY "** is a bonafide and genuine research work done by **Dr. SATHEESH. P.** under my direct supervision and guidance, submitted to the Tamil Nadu Dr. M.G.R. Medical University, in partial fulfilment of the requirement for the degree of MD in Anaesthesiology.

Date:

Place:

DR .A. PARAMASIVAN, MD.,DA.
PROFESSOR,
INSTITUTE OF ANAESTHESIOLOGY,
GOVT. RAJAJI HOSPITAL &
MADURAI MEDICAL COLLEGE,
MADURAI.

DR .R.GANESAPANDIAN,MD.
ASSISTANT PROFESSOR,
INSTITUTE OF ANAESTHESIOLOGY,
GOVT. RAJAJI HOSPITAL &
MADURAI MEDICAL COLLEGE,
MADURAI.

CERTIFICATE FROM THE DEAN

This is to certify that this dissertation entitled **"COMPARISON OF TRACHEAL INTUBATION USING AIRTRAQ AND McCOY LARYNGOSCOPE IN THE PRESENCE OF RIGID CERVICAL COLLAR SIMULATING CERVICAL IMMOBILISATION FOR TRAUMATIC CERVICAL SPINE INJURY "** is a bonafide and genuine research work done by **Dr.SATHEESH. P.** in partial fulfillment of the requirement for the degree of MD in Anaesthesiology under guidance of **PROF. DR. A. PARAMASIVAN,M.D,DA.** Professor of Anaesthesiology, Institute of Anaesthesiology.

Date:

Place:

(Capt) Dr.B.SANTHAKUMAR, M.Sc (F.sc), M.D (F.M). PGDMLE, D.N.B (F.M),

DEAN,

GOVT. RAJAJI HOSPITAL &

MADURAI MEDICAL COLLEGE,

MADURAI.

DECLARATION

I **Dr. SATHEESH. P.,** solemnly declare that this dissertation entitled **"COMPARISON OF TRACHEAL INTUBATION USING AIRTRAQ AND McCOY LARYNGOSCOPE IN THE PRESENCE OF RIGID CERVICAL COLLAR SIMULATING CERVICAL IMMOBILISATION FOR TRAUMATIC CERVICAL SPINE INJURY"** has been done by me. I also declare that this bonafide work or a part of this work was not submitted by me or any other for any award, degree, or diploma to any other University or board either in India or abroad.

This is submitted to The Tamilnadu Dr. M. G. R. Medical University, Chennai in partial fulfilment of the rules and regulations for the award of Doctor of Medicine degree Branch –X (Anesthesiology) to be held in April 2015.

Place: Madurai **Dr. SATHEESH .P**

Date:

ACKNOWLEDGEMENT

I am greatly indebted to **Dr.S.C.GANESH PRABU,M.D., D.A.,** Director of the Institute of Anaesthesiology, Madurai Medical College, Madurai for his guidance and encouragement in preparing this dissertation.

My heartful thanks to **Dr. A. PARAMASIVAN, M.D.,D.A.,** Professor of Anaesthesiology, Madurai Medical College, Madurai, for his guidance in doing this work.

I also thank my Professors **Dr.T.THIRUNAVUKKARASU M.D., D.A., Dr.R.SHANMUGAM, M.D., & Dr.EVELYN ASIRVATHAM, M.D., D.G.O., D.C.H** for their constant support and guidance in performing this study.

I also thank my Assistant Professor **Dr. R.GANESA PANDIAN M.D,** for his constant support in conducting this study.

My profound thanks to **Capt**.**Dr.B.SANTHAKUMAR, M.sc(F.sc), M.D(F.M).PGDMLE, Dip.N.B (F.M), DEAN,** Madurai Medical College and Government Rajaji Hospital, Madurai for permitting me to utilize the clinical materials of this hospital in the completion of my dissertation.

I gratefully acknowledge the patients who gave their consent and cooperation for this study.

CONTENTS

COMPARISON OF TRACHEAL INTUBATION USING THE AIRTRAQ AND MC COY LARYNGOSCOPE IN THE PRESENCE OF RIGID CERVICAL COLLAR SIMULATING CERVICAL IMMOBILISATION FOR TRAUMATIC CERVICAL SPINE INJURY

ABSTRACT

Background:

It is difficult to visualise the larynx using conventional laryngoscopy in the presence of cervical spine immobilisation. Airtraq provides for easy and successful intubation in the neutral neck position.

Objective:

To evaluate the effectiveness of Airtraq in comparison with the McCoy laryngoscope, when performing tracheal intubation in patients with neck immobilisation using hard cervical collar and manual in-line axial cervical spine stabilisation.

Methods:

A randomised, cross-over, open-labelled study was undertaken in 60 ASA I and II,30 patients in each group, patients aged between 20 and 60 years, belonging to either gender, scheduled to undergo elective surgical procedures. Following induction and adequate muscle relaxation, they were intubated using either of the techniques first, followed by the other. Intubation time and

Intubation Difficulty Score (IDS) were noted using McCoy laryngoscope and Airtraq. Chi-square test was used for comparison of categorical data between the groups and paired sample t-test for comparison of continuous data. IDS score were compared using Wilcoxon Signed ranked test.

Results:

The mean intubation time was 35.37± 0.81 sec for McCoy laryngoscopy and 29.6± 0.89sec for Airtraq ($P<0.001$). The median IDS values were 4 for McCoy and 0 (0–1) for Airtraq,respectively ($P<0.001$). The median Cormack Lehane glottic view grade was 3 (IQR 3–4) and 1(IQR 1–1) for McCoy laryngoscopy and Airtraq, respectively ($P<0.001$). There were two failures to intubate with the Airtraq.

Conclusion:

Airtraq improves the ease of intubation significantly when compared to Mc Coy blade in patients immobilised with cervical collar and manual in-line a stabilisation simulating cervical spine injury.

Key words:

Airtraq, Mc Coy laryngoscope, immobilization, cervical spine injury.

INTRODUCTION

It is a significant challenge even to the most experienced anaesthesiologist to intubate patients in whom the movement of the cervical spine is not desirable or restricted. In cases of cervical spine immobility or instability, the use of direct laryngoscopy is reserved: it requires flexion of the cervical spine and atlanto‑occipital extension for alignment of the oral, pharyngeal and laryngeal axis to create a direct line of vision from the mouth to the vocal cords. Tracheal intubation in patients with suspected neck injuries should achieve two contradicting goals: sufficient laryngeal exposure and the least cervical spine movement. As the former involves movement of the cervical vertebrae, intubation has to be performed using cervical spine immobilisation to prevent exacerbation of spinal cord injuries. Protective measures to avoid deleterious compression forces on the spinal column include application of rigid collar, a forehead tape and manual‑in‑line stabilisation (MILS).

Cervical collar application reduce cervical spine movements, obstruct tracheal intubation with conventional laryngoscopy. The cervical collar also significantly reduces the mouth opening, rendering laryngoscopy difficult. Besides, the neck collar lifts up the chin and tips the larynx anteriorly'. Removing the anterior portion of the collar can facilitate tracheal intubation. This jeopardise the safety of the cervical spine. MILS that is recommended for cervical spine immobilisation further impairs glottic visualization.

Fibreoptic intubation is the most reliable method in patients with cervical trauma, but it may be difficult in patients with restricted neck movement. The other drawbacks of fiberoptic intubation are lack of availability of equipment, requires lack of expertise in its use and difficulty in using it if the patient is not co-operative or if there is blood or secretions in the airway.

The unique curving blade of the Airtraq is designed to fit the oropharyngeal anatomy. It possesses considerable advantages in the setting of cervical spine immobilization, when direct laryngoscopy is difficult or not recommended. It provides a full view of the glottis without requiring to align the airway axis. In addition, the Airtraq laryngoscope also appears to cause less cervical spine movements during tracheal intubation when compared with the Macintosh or McCoy laryngoscopes. Tracheal intubation with Airtraq faciliates the neck in neutral position, similar to the neck position maintained by a rigid cervical collar. Cervical collar in combination with forehead strapping and MILS virtually obliterates even the small neck movements which normally facilitate airway insertion.

The present study evaluates the efficacy of Airtraqin patients undergoing cervical spine immobilization with rigid cervical collar and MILS, simulating the situation of cervical trauma, and compares it with the Mc Coy laryngoscope.

AIMS & OBJECTIVES

To evaluate the effectiveness of Airtraq in comparison with the Mc Coy laryngoscope, when performing tracheal intubation in patients with neck immobilization using hard cervical collar and manual in-line axial cervical spine stabilization.

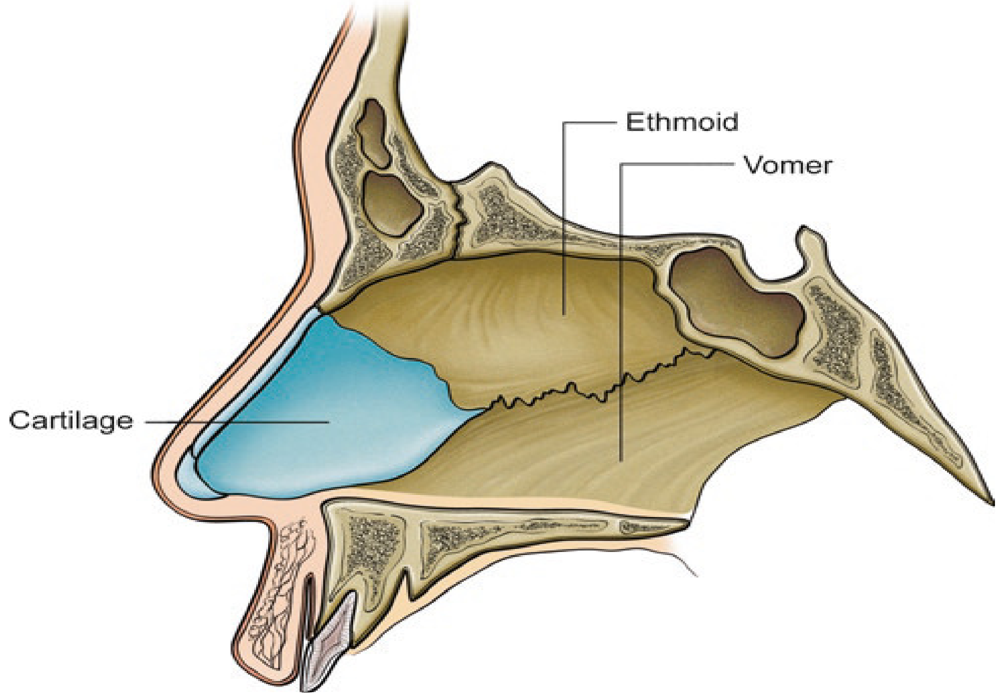
Airway Anatomy

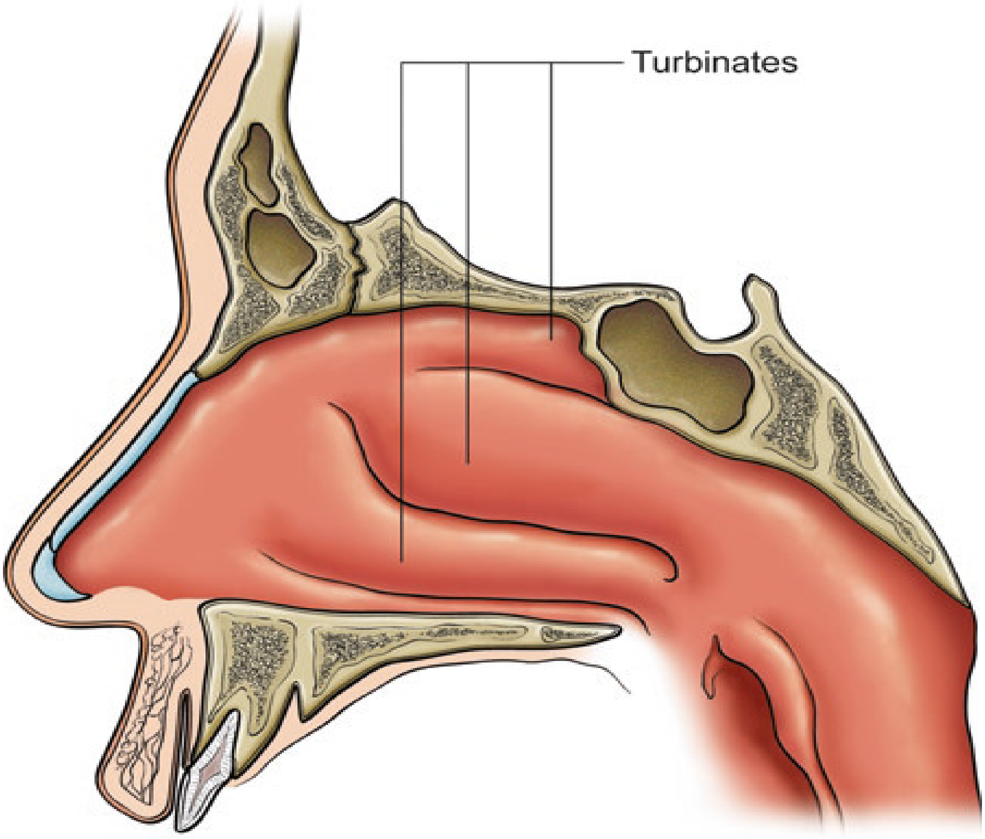
Knowledge of anatomy is essential to the study of airway management. First, anatomical considerations are helpful in diagnosing certain problems, such as the position of a foreign body in a patient with airway obstruction. Second, since some procedures involved in establishing and maintaining an airway are performed under emergency conditions, little if any time may be available for reviewing anatomy. Third, in many procedures involving the airway, such as tracheal intubation, anatomical structures are only partially visible. As a result, one must recognize not only the structures in view but also their spatial relationship to the surrounding structures. This chapter reviews basic airway anatomy, discusses some clinical correlates, and includes a comparison of the pediatric and adult airway.

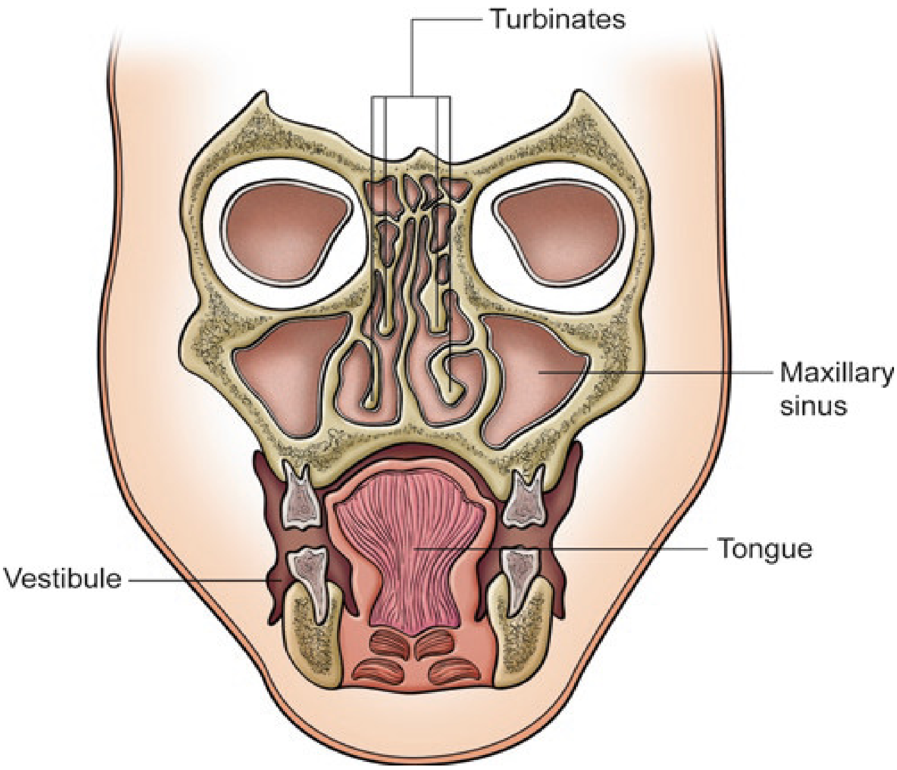
Nose

The nose is a pyramidal-shaped structure projecting from the midface made up of bone, cartilage, fibrofatty tissue, mucous membrane, and skin. It contains the peripheral organ of smell and is the proximal portion of the respiratory tract. The nose is divided into right and left nasal cavities by the nasal septum. The inferior portion of the nose contains two apertures called the anterior nares. Each naris is bounded laterally by an ala, or wing. The posterior portions of the nares open intothe nasopharynx and are referred to as choanae. One or both of these apertures are absent in the congenital anomaly choanal atresia. Infants born with this condition are at risk of suffocation as they are compulsive nose breathers at birth. Urgent surgical correction of choanal atresia is required soon after birth in these cases..

Each side of the nose consists of a floor, a roof, and medial and lateral walls. The septum forms the medial wall of each nostril and is made up ofperpendicular plates of ethmoid and vomer bones and the septal cartilage. The bony plate forming the superior aspect of the septum is very thin and descends from the cribriform plate of the ethmoid bone. The cribriform plate may be fractured following trauma. Head injury victims should be questioned about nasal discharge, which may be cerebrospinal fluid (CSF). Nasotracheal intubation and the passage of nasogastric tubes are relatively contraindicated in the presence of basal skull fractures. The lateral walls have a bony framework attached to which are three bony projections referred to as conchae or turbinates. The upper and middle conchae are derived from the medial aspect of the ethmoid; the inferior concha is a separate structure. There are a number of openings in the lateral nasal walls that communicate with the paranasal sinuses and the nasolacrimal duct. Coronal section of nose and mouth shows the relationships of the nasal structures.


Ethmoid
Vomer
Cartilage


Turbinates



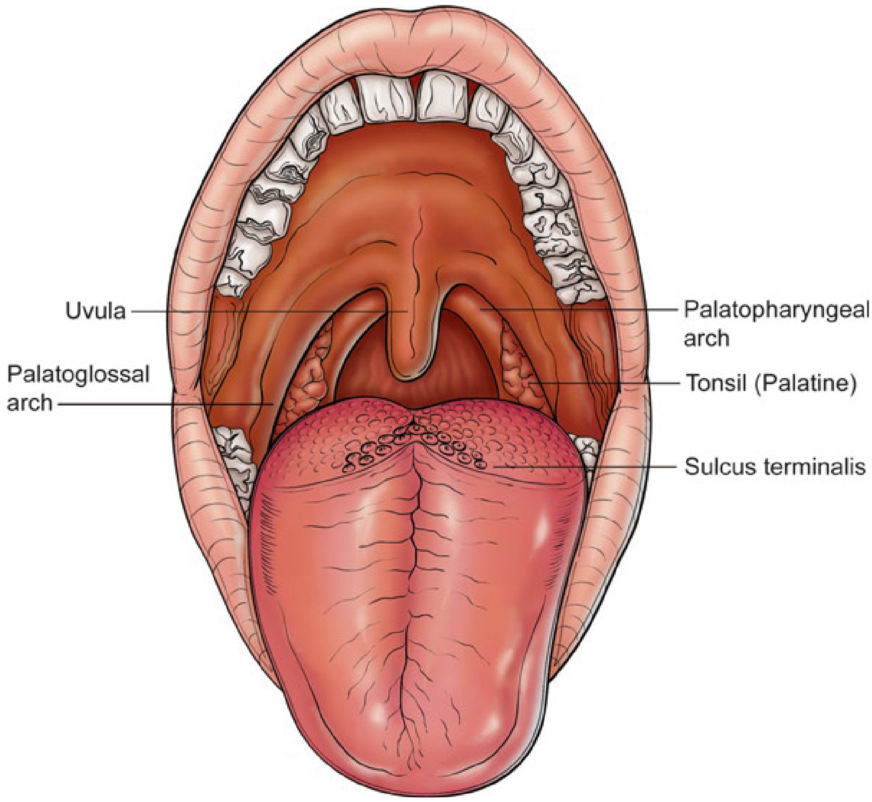
Nasal endotracheal tubes should be well lubricated, and vasoconstrictors solutions should be applied to the nasal mucosa before instrumentation. When introducing a nasal endotracheal tube into the nostril, the bevel of the tube should be parallel to the nasal septum to avoid disruption of the conchae .

Oral Cavity

The oral cavity divided into two parts: the vestibule and the oral cavity proper. The vestibule is the space between the lips and the cheeks externally and the gums and teeth internally. The oral cavity proper is bounded anterolaterally by the alveolar arch, teeth, and gums; superiorly by the hard and soft palates; and inferiorly by the tongue. Posteriorly, the oral cavity communicates with the palatal arches and pharynx.

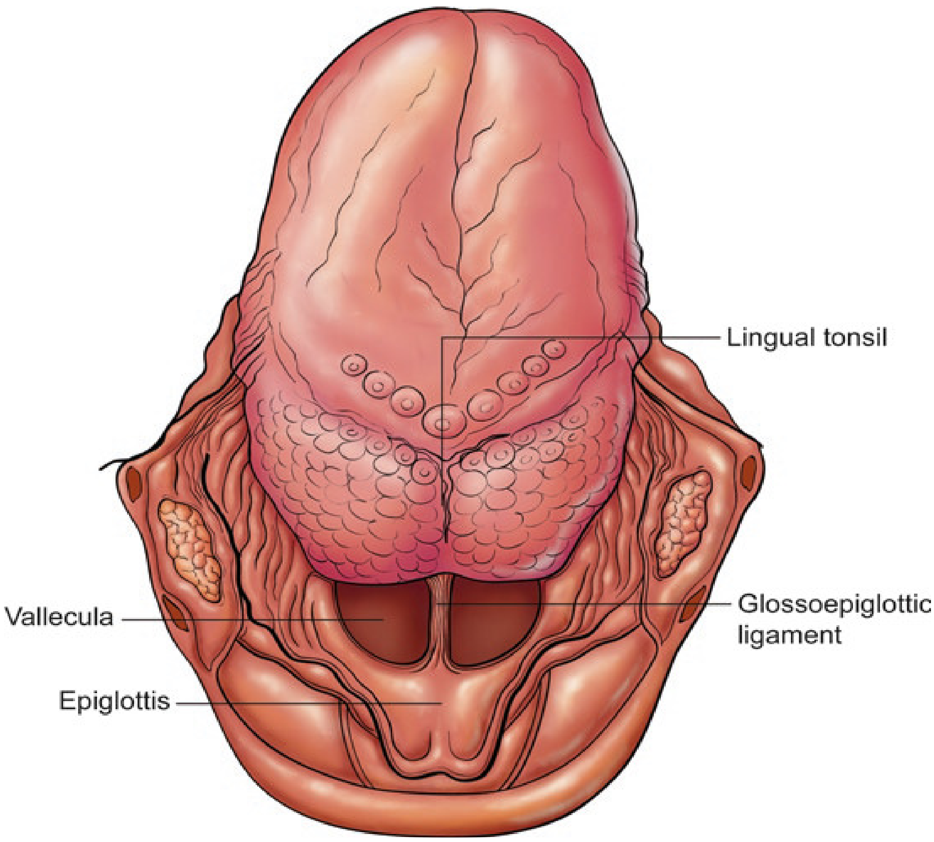
Uvula

In the posterior aspect of the mouth, the soft palate is shaped like the letter *M,* with the uvula as the centerpiece. This structure is a useful landmark for practitioners assessing the ease or difficulty of mask ventilation or tracheal intubation.



Tonsils

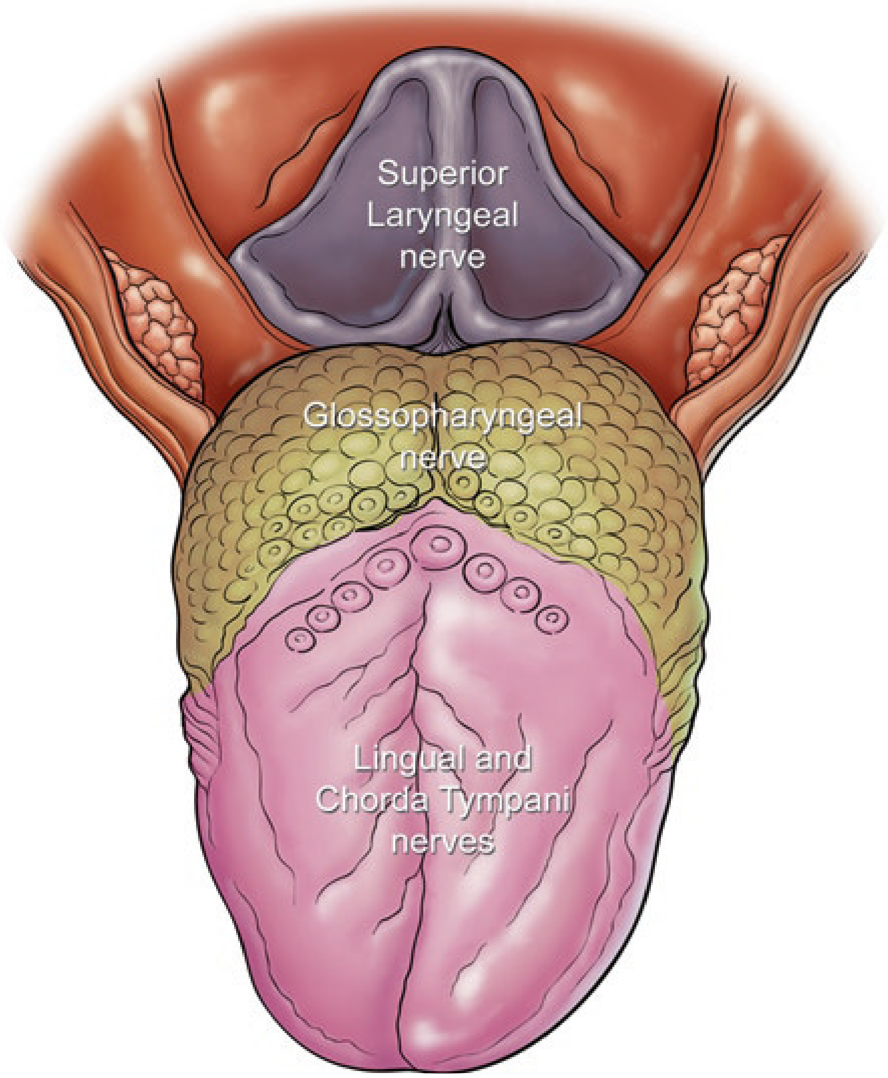
The tonsils that seen in the mouth are formally known as the palatine tonsils are collections of lymphoid tissue engulfed by two soft tissue folds, the pillars of the fauces. The anterior fold is called the palatoglossal arch, and the posterior, the palatopharyngeal arch. There is a collection of lymphoid tissue called the "tonsillar ring" which is situated in an incomplete circular ring around the pharynx. It is made up of the palatine tonsils , the pharyngeal tonsil, tubular tonsils , and the lingual tonsil . The lingual tonsil has a cobblestone appearance. Hypertrophy of the pharyngeal tonsil (adenoids) can obstruct the nasal airway, necessitating mouth breathing. Hearing may be impaired when the tubular tonsils become infected. Hypertrophy of the lingual tonsil may cause airway obstruction, difficult mask ventilation, and difficult tracheal intubation.



Tongue- Nerve Supply

The sensory and motor innervation of the tongue is quite diverse and includes fibers from a number of different sources. Sensory fibers for the anterior two thirds are provided by the lingual nerve. Taste fibers are furnished by the chorda tympani branch of the nervus intermedius (from the facial nerve

[VII]). Sensory fibers for the posterior third come from the glossopharyngeal nerve (IX)

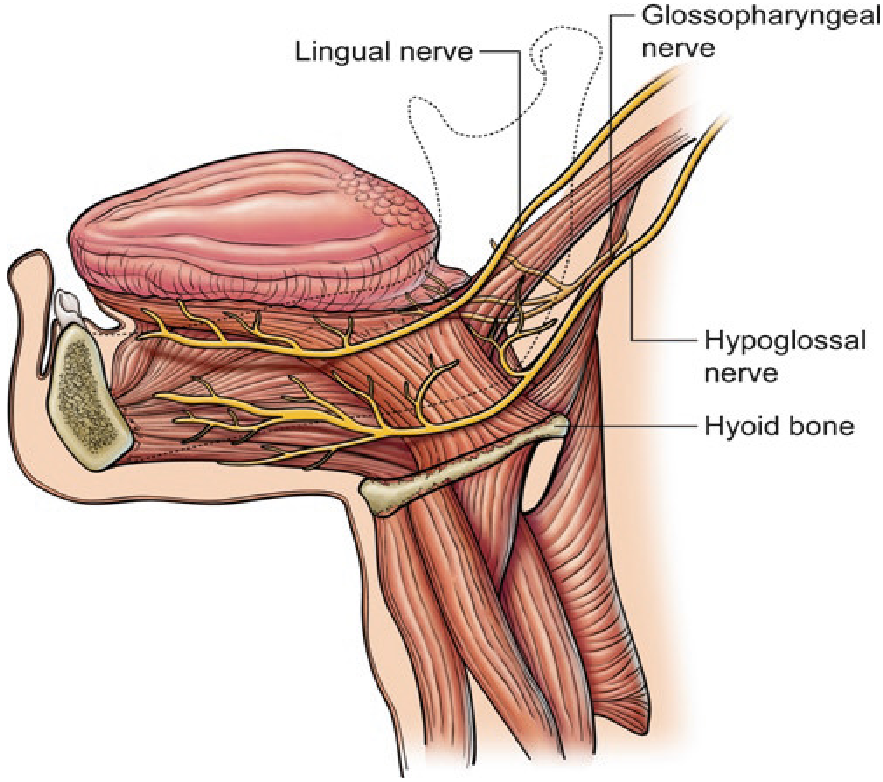


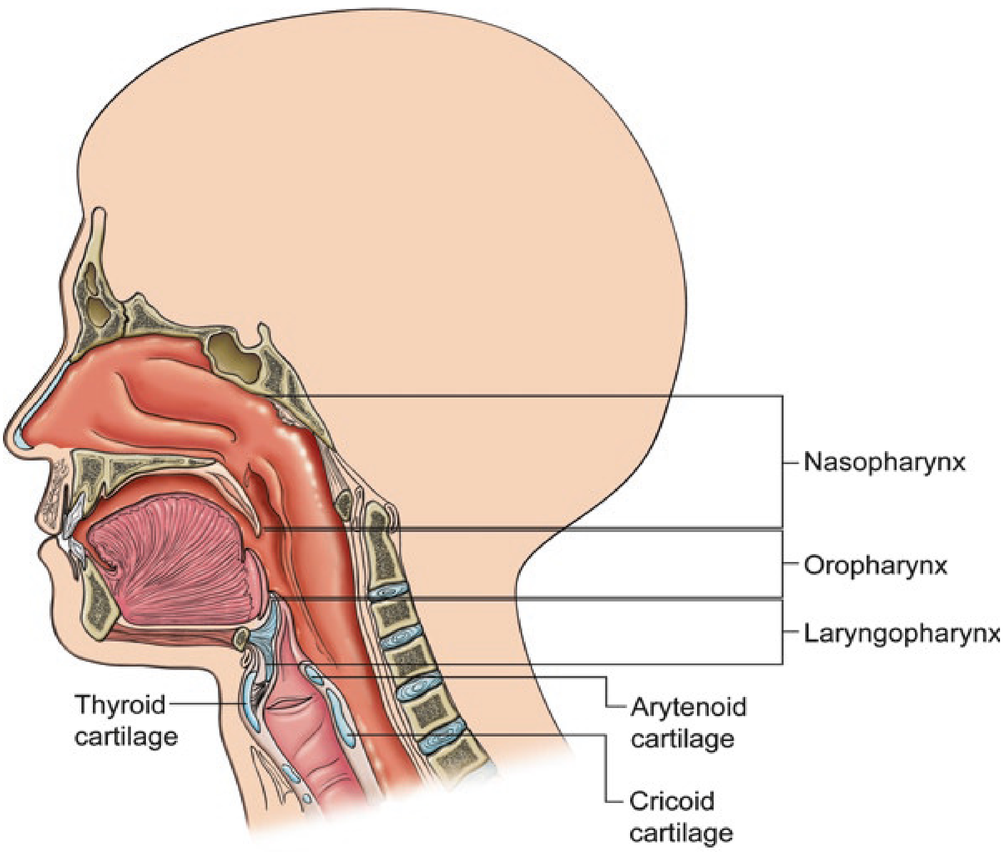
.

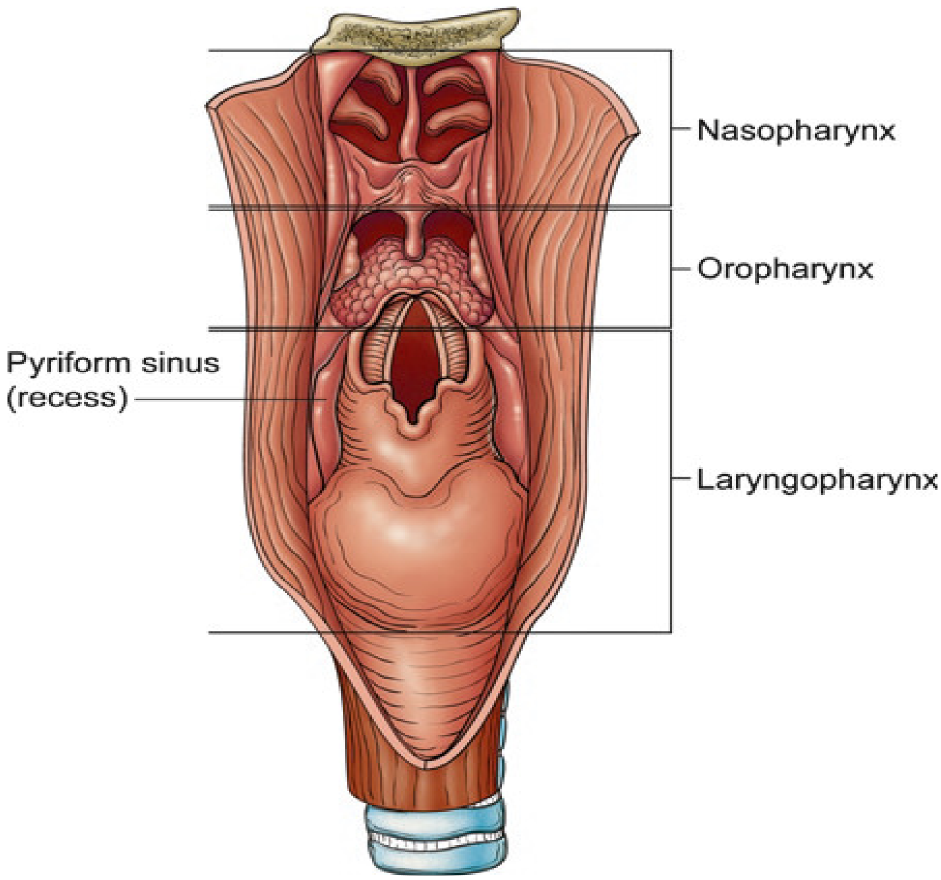
The Macintosh laryngoscope is inserted into the vallecula during laryngoscopy and likely to elicit a vagal response because the innervations of the vallecula is provided by the glossopharyngeal nerve. When straight blades are used for laryngoscopy they are inserted with the intention of exposing the laryngeal opening by placing the blade beneath the inferior surface of the epiglottis. The inferior surface of the epiglottis is innervated by the superior laryngeal nerve. one is more likely to encounter vagal stimulation during laryngoscopy with a straight blade (Miller or Henderson). The major motor nerve supply of the tongue is from the hypoglossal nerve (XII). Which passes above the hyoid bone and is distributed to the lingual muscles. The nerve is very superficial at the angle of the mandible, it is prone to injury during vigorous manual manipulation of the airway.

Pharynx

The pharynx is a musculo-membranous passage between the choanae, the posterior oral cavity, the larynx, and esophagus. It extends from the base of the skull to the inferior border of the cricoid cartilage anteriorly and the lower border of C6 posteriorly. It is approximately 15 cm long. Its widest point is at the level of the hyoid bone and the narrowest at the lower end where it joins the esophagus. Figures show sagittal and posterior views of the pharynx. In a normal conscious patient, the gag reflex may be elicited by stimulating the posterior pharyngeal wall. The afferent and efferent limbs of this reflex are mediated through the glossopharyngeal (IX) and vagus (X) nerves.


Glossopharyngeal nerve
Lingual nerve
Hypoglossal nerve
Hyoid bone


Nasopharynx
Oropharynx
Laryngopharynx
Thyroid cartilage
Arytenoid cartilage
Cricoid cartilage

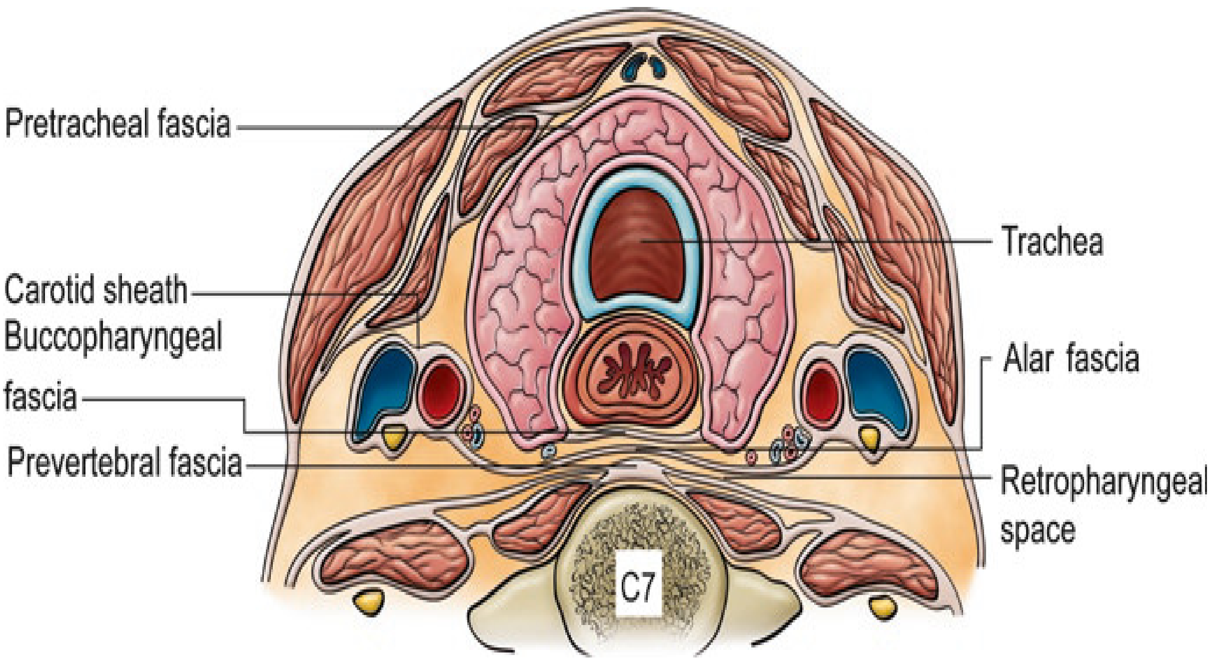


Prevertebral Fascia

The prevertebral fascia extends from the base of the skull down to the third thoracic vertebra, where it continues as the anterior longitudinal ligament. It also extends laterally as the axillary sheath. Abscess formation, hemorrhage following trauma, or tumor growth may cause swelling in this area and lead to symptoms of airway obstruction.

Retropharyngeal Space

The retropharyngeal space (RPS) is a potential space lying between the prevertebral fascia and the buccopharyngeal fascia, posterior to the pharynx in the midline. It is confined above by the base of the skull and inferiorly by the superior mediastinum. The normal contents of the RPS are lymph nodes and fat.



Pus from infected teeth can enter this space and reach the thorax. Infectious material may penetrate the prevertebral fascia and enter the RPS causing difficulty swallowing and airway obstruction. Tumors may invade this space and compromise the airway. It is very difficult to access the RPS clinically; we are very dependent on imaging techniques (CT and MR) to make a diagnosis of airway obstruction caused by infection or tumor in this space.

Larynx

Larynx is a boxlike structure situated in the anterior portion of the neck and lies between C3 and C6 in the adult. Larynx is shorter in women and children and is situated at a slightly higher level. It occupies a volume of 4–5 cc in adults and is made up of cartilages, ligaments, muscles, mucous membranes, nerves, blood vessels, and lymphatics. Average length of the larynx is 44 mm in the male and 36 mm in the female. Average antero-posterior diameter is 36 mm in the male and 26 in the female and the average transverse diameter is 36 mm in the male and 26 mm in the female. Larynx is one of the most powerful sphincters in the body and is an important component of the airway. Functionally, the larynx was designed as a protective valve to prevent food and other foreign substances from entering the respiratory tract. With evolution, the larynx became a highly sophisticated organ of speech when used in combination with the lips, the tongue and the mouth and is one of the distinguishing features of mankind separating us from other primates. The voice change in males occurs at puberty in most cases when the cartilages become larger. Adam's apple is more prominent in males following puberty because the angle made between the thyroid laminae is smaller in males and the antero-posterior diameter of the laminae is greater. This gender difference is usually evident by the 16th year. Fractures of the larynx may occur during various sporting activities including boxing, karate, kick boxing, and other major contact sports. Injury may also occur in ice hockey, baseball, or cricket and during attempted strangulation from any cause. It may also occur from compression by a seat belt following motor vehicle accidents. The symptoms and signs of a fractured larynx include: laryngeal distortion, hoarseness, aphonia, aberrant vocalization, airway obstruction, choking, cyanosis, and death.

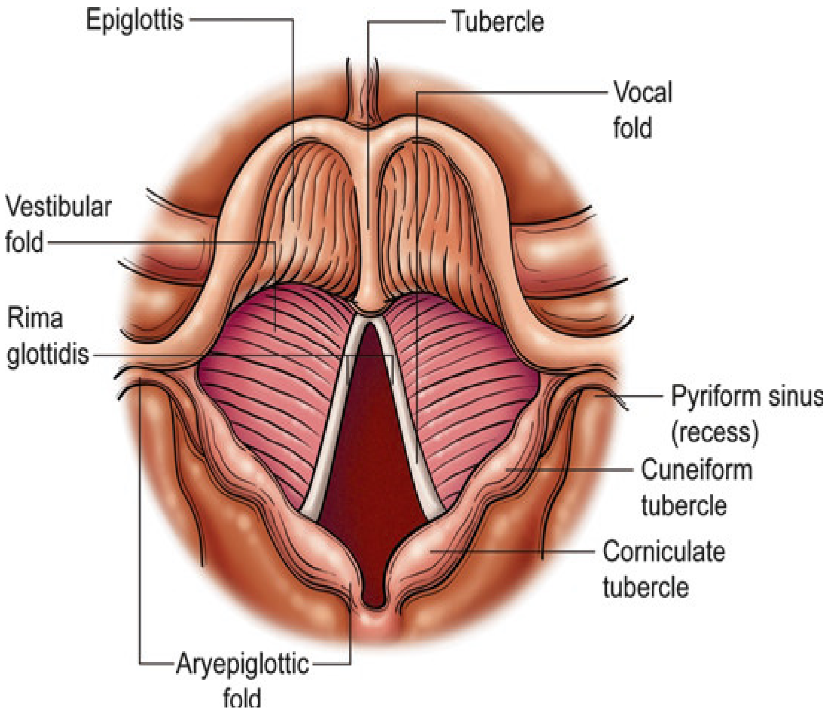
Cartilages of Larynx

The larynx consists of three single cartilages (the epiglottis, the thyroid, and the cricoid); and three paired cartilages (the arytenoids, the corniculates, and the cuneiforms).

Single Cartilages

Epiglottis

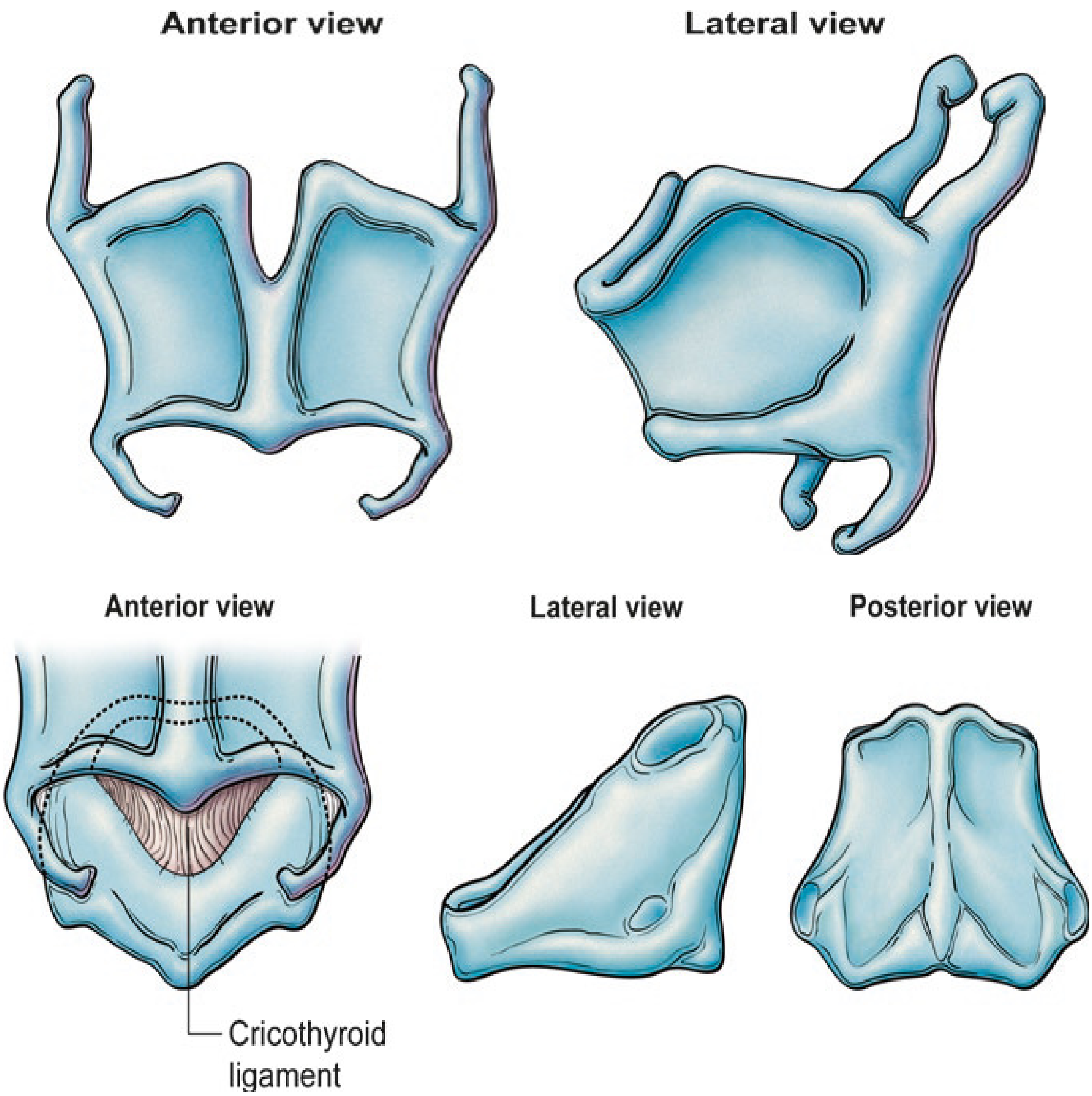
The epiglottis, a well-known landmark to those performing tracheal intubation, is shaped like a leaf. At its lower end, attached to the thyroid cartilage by the thyroepiglottic ligament. Its upper, rounded part is free and lies posterior to the tongue, and is attached by the median glossoepiglottic ligament. The epiglottis is attached to the hyoid bone anteriorly by the hyoepiglottic ligament. Small depressions on either side of this ligament are referred to as the valleculae. There is a recognizable bulge in the midportion of the posterior aspect of the epiglottis called the tubercle. During swallowing, as the laryngeal muscles contract, the downward movement of the epiglottis and the closure and upward movement of the glottis prevent food from entering the larynx. When the epiglottis becomes acutely inflamed and swollen (in association with acute epiglottitis), life threatening airway obstruction may occur. The epiglottis has no function in the process of swallowing, breathing or phonation.



Thyroid Cartilage

The thyroid cartilage is a shield like structure best visualized diagrammatically. Anteriorly, the two plates come together to form a notch that is more prominent in men than in women. At the posterior aspect of each lamina there are horns on the superior and inferior aspects. The inferior horn has a circular facet that allows it to articulate with the cricoid cartilage.

Cricoidcartilage is shaped like a signet ring, with the bulky portion placed posteriorly. It has articular facets for its attachment with the thyroid cartilage and the arytenoids. It is separated from the thyroid cartilage by the cricothyroid ligament, or membrane. The inferior portion of the thyroid cartilage is connected to the superior border of the cricoid cartilage by the cricothyroid ligament. In acute airway obstruction,



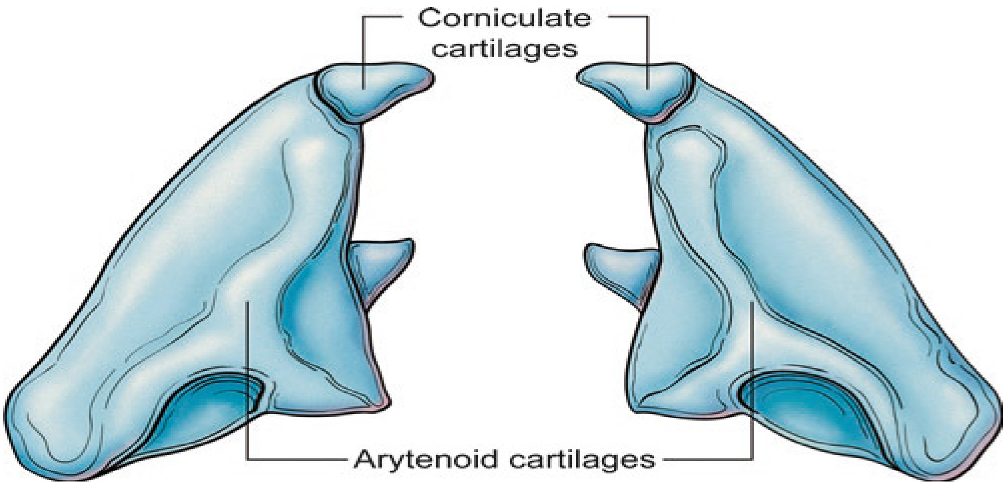
the cricothyroid membrane was pierced with a needle, knife, or tube and connected to an oxygen source. This procedure is called cricothyrotomy and is usually the first surgical procedure performed to relieve asphyxiation. Downward pressure on the cricoid cartilage is required to prevent passive regurgitation of gastric contents during induction of anesthesia in nonfasting patients and in emergencysituations. This is also known as Sellick’s maneuver.

The Paired Cartilages

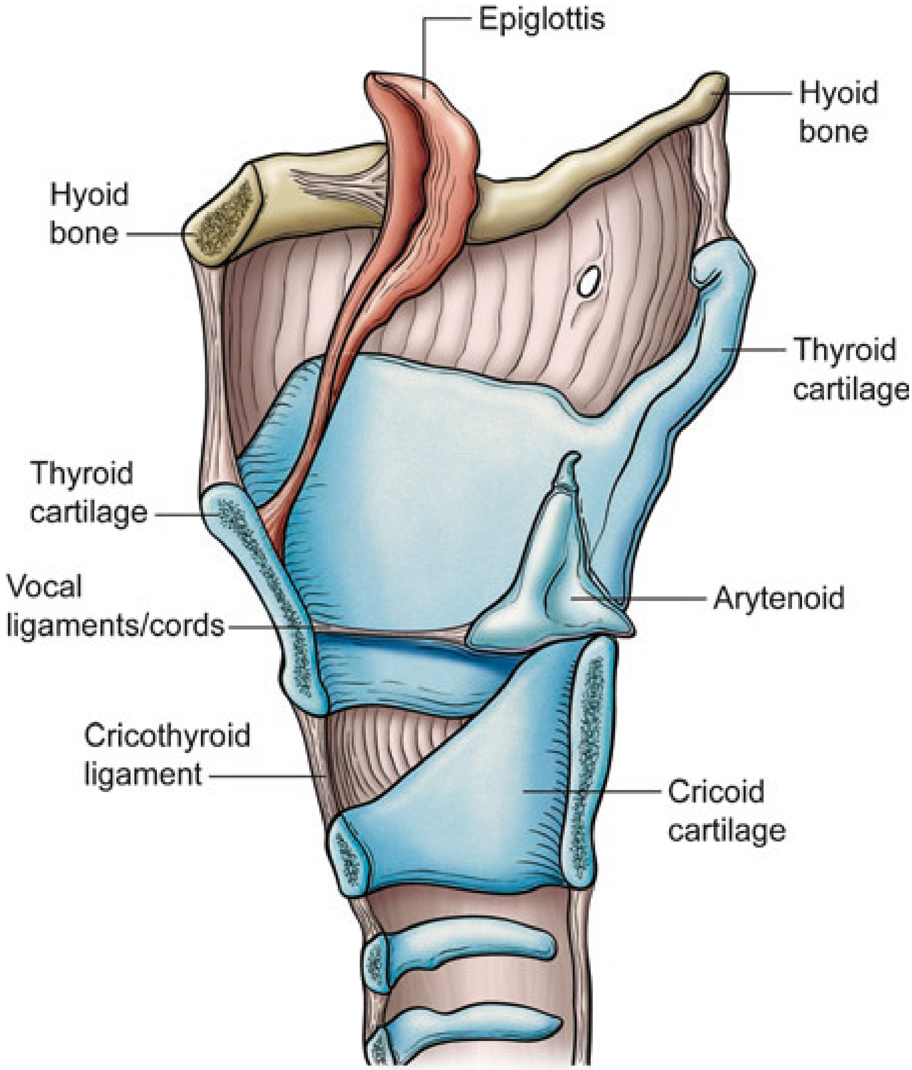
Cuneiform,Corniculates,&Arytenoids:

The paired cartilages include: the arytenoids, the corniculates, and the cuneiformcartilages. The arytenoids are triangular structures located on the posterosuperior aspect of the cricoid cartilage. The corniculate cartilages articulate with the superior aspect of the arytenoids. The cuneiform cartilages are small round shaped structures and are embedded in the aryepiglottic fold or ligament bilaterally. The Hyoid Bone- hyoid bone, which is not part of the larynx proper, is a horseshoe shaped structure located in the central part of the neck and lies between the floor of the mouth and the thyroid cartilage. It has no bony articulation. It is connected to the thyroid cartilage by the thyrohyoid ligament anterolaterally. The greater horn of the hyoid bone articulates with the superior horn of the thyroid cartilage posteriorly. It is connected to the floor of the mouth, the base of the skull and the cervical spine by a series of muscles and ligaments. Calcification of the stylohyoidligaments bilaterally has been associated with difficult tracheal intubation. The hyoid bone is not easily fractured and when fractures occur strangulation is usually suspected.

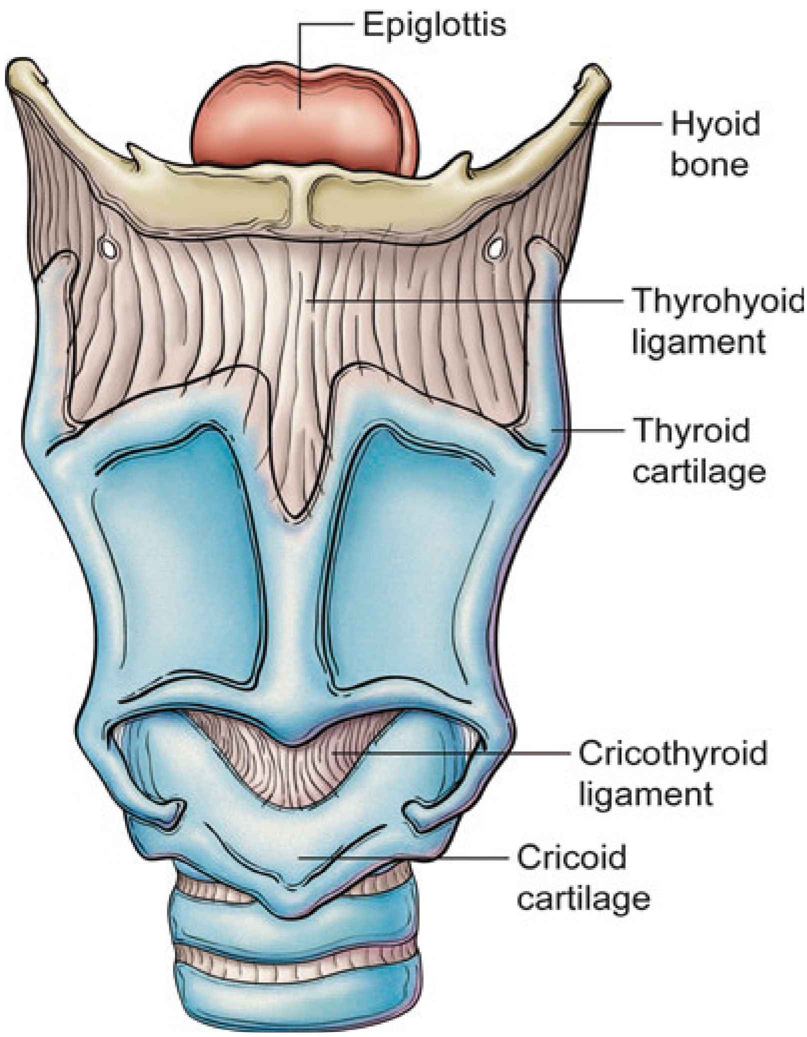
The hyoid bone is an important structure in relation to airway management.



corniculates and arytenoids



Sagittal view - Larynx



Anterior view – Larynx

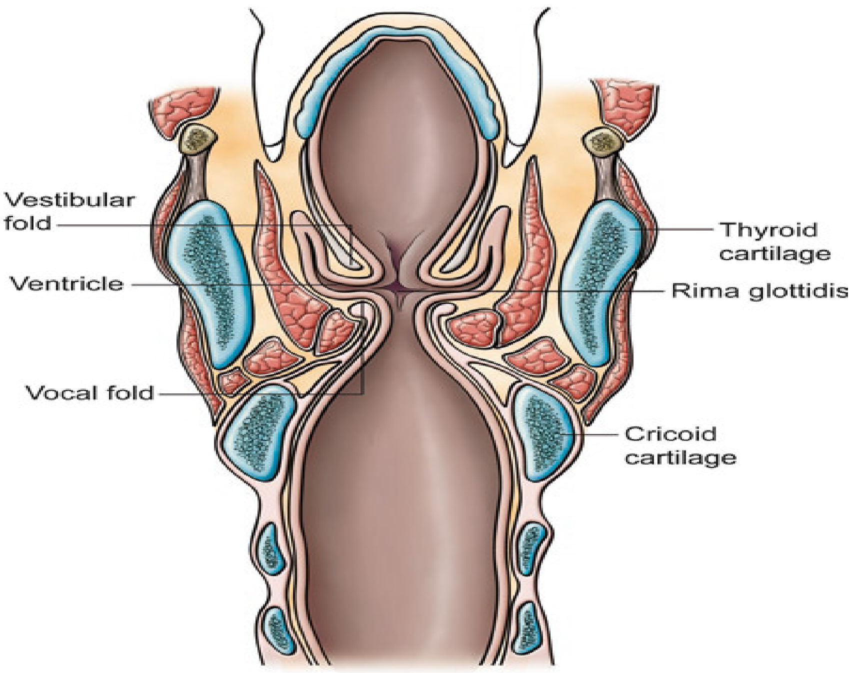
Laryngeal Cavity

The space between the true vocal cords and the arytenoid cartilages is referred to as the rima glottidis. This landmark divides the larynx into two parts: the upper compartment extends from the laryngeal outlet to the vocal cords and contains the vestibular folds and the sinus of the larynx; the lower compartment extends from the vocal cords to the upper portion of the trachea. The terms *glottis* and rima glottidis are often used interchangeably. The difference is that the *glottis* is an all encompassing

term which includes the vocal and vestibular folds including the opening into the larynx. The actual space between the true vocal cords is the rima glottidis.

Piriform Sinus (Recess or Fossa)

There is a space between the epiglottis and the aryepiglottic folds medially, and the hyoid bone, thyrohyoid ligament, and thyroid cartilage laterally, referred to as the piriform sinus, recess, or fossa (see Figs. 1.9 and 1.11). Occasionally, fish bones and other organic material may be entrapped in this space, giving rise to symptoms of dysphagia. Local anesthetic soaked pledgets may be inserted into the piriform sinus on each side to block the internal branch of the superior laryngeal nerve, using an angled forceps (Krause forceps).



Coronal view - Larynx

Larynx- Nerve supply

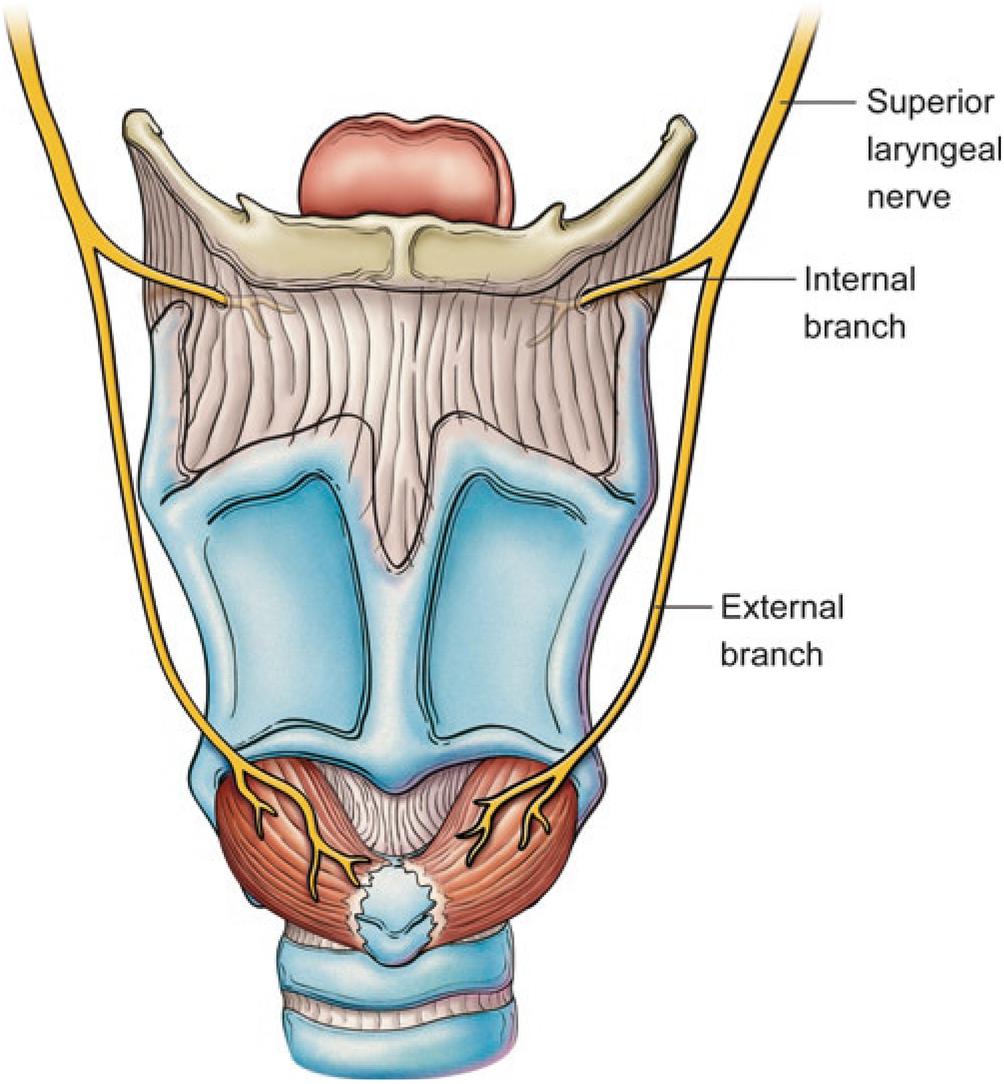
The larynx is innervated by two branches of the vagus: ‘the superior laryngeal and the recurrent laryngeal nerves’.

Superior Laryngeal Nerve

The superior laryngeal nerve arises from the ganglion nodosum and descends inferiorly and medially to reach the internal side of the larynx. It communicates with the cervical sympathetics, passing between the greater horn of the hyoid bone and the superior horn of the thyroid cartilage, and divides into an external (motor) branch that descends to supply the cricothyroid muscle and an internal (sensory) branch that pierces the thyrohyoid membrane; it then divides into upper and lower branches that supply the mucous membrane of the base of the tongue, pharynx, epiglottis, and larynx.

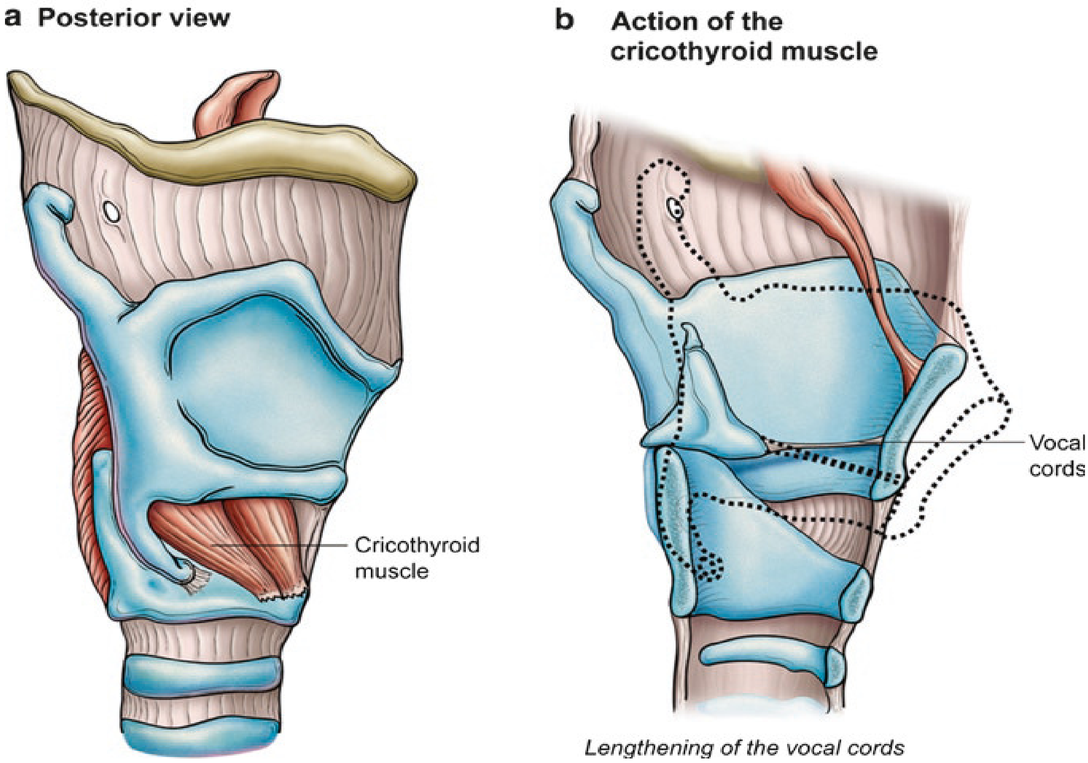
Recurrent Laryngeal Nerve

The recurrent laryngeal nerve arises from the vagus nerve and loops around the subclavian artery on the right side and the aortic arch on the left side behind the ligamentum arteriosum. After ascending between the trachea and esophagus, it passes behind the thyroid gland and innervates all of the intrinsic muscles of the larynx except the cricothyroid. In addition, it supplies sensory branches to the mucous membrane of the larynx below the vocal cords. In the event of bilateral recurrent laryngeal nerve damage (secondary to thyroidectomy, neoplasm, or trauma), the action of the superior laryngeal nerve is unopposed leading to varying degrees of airway obstruction. Complete paralysis of the recurrent laryngeal and superior laryngeal nerves simultaneously is characterized by a midway positioning of the vocal cords, often referred to as the cadaveric position, and frequently seen following the administration of neuromuscular blocking drugs. A reflexive, forceful contraction of all the laryngeal muscles, as commonly occurs when a foreign body lodges in the larynx is referred to as laryngospasm'. laryngospasm normally serves a protective function, in such cases it may exacerbate an existing airway obstruction.



larynx- nerve supply

Cricothyroid Muscles of Larynx

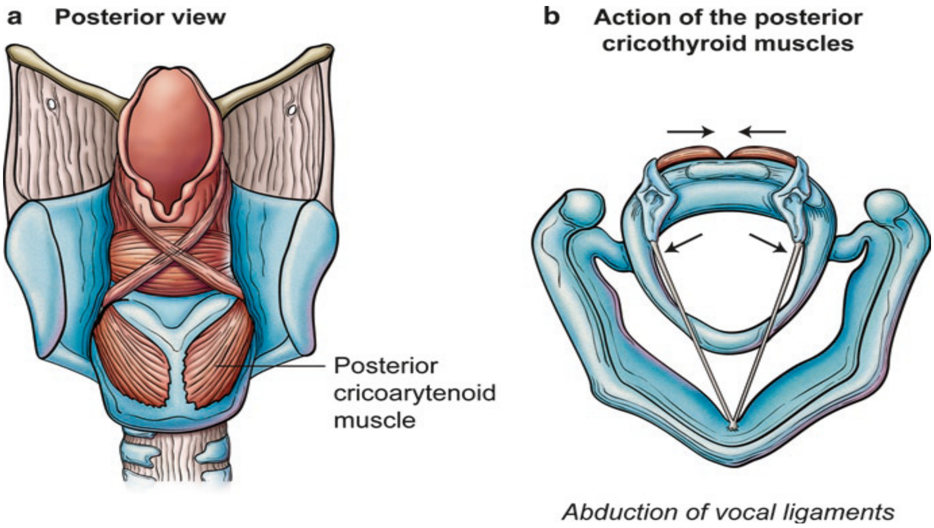


Cricothyroid muscle- Anatomy & Action

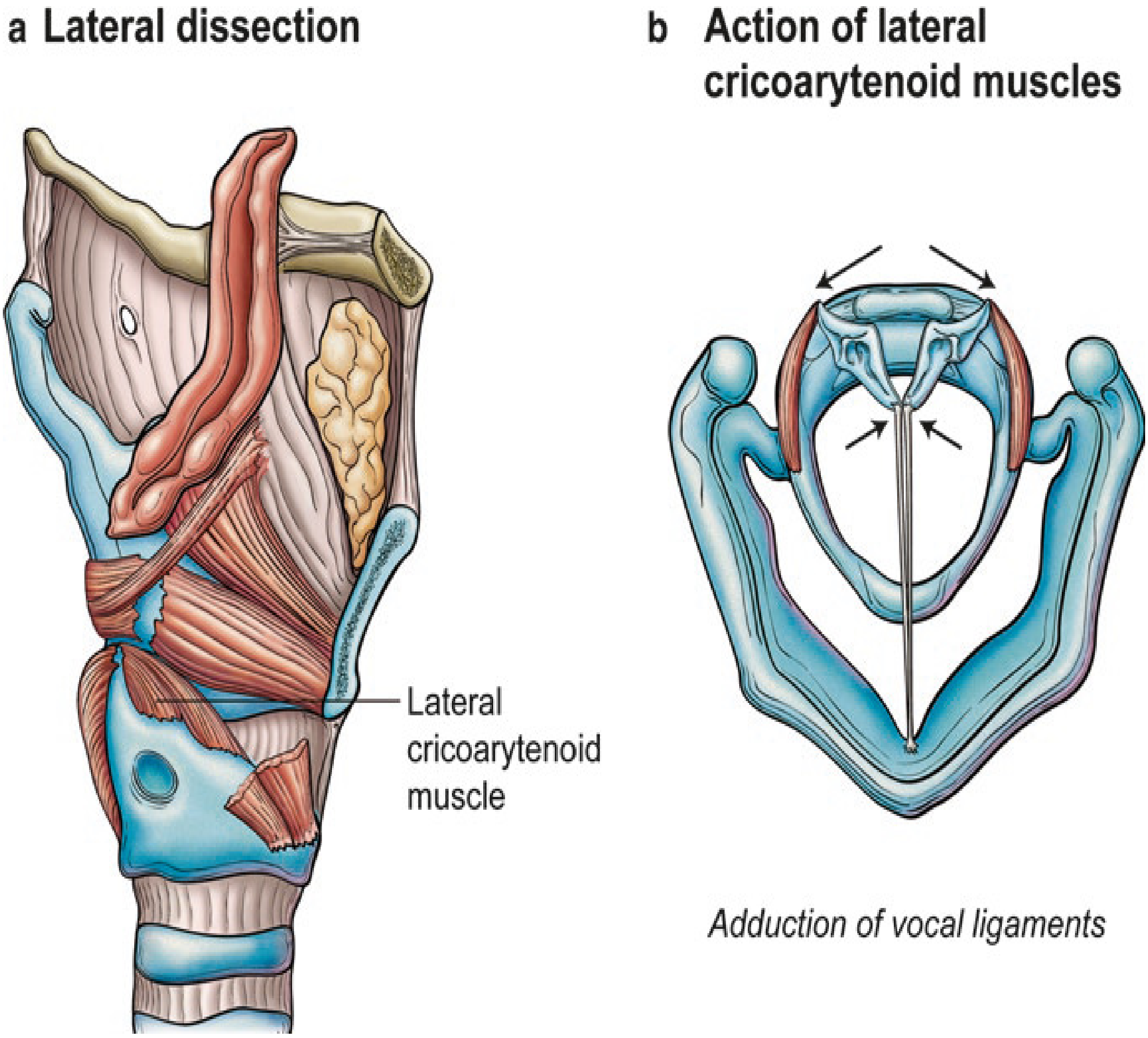
Contraction of the cricothyroid muscles results in a forward tilting of the thyroid cartilage on the cricoid, resulting in lengthening and increased tension on the vocal cords. Contraction of the posterior cricoarytenoid muscle results in *abduction* of the vocal cords. Contraction of the lateral cricoarytenoids results in *adduction* of the vocal ligaments.

Trachea and Bronchi

The trachea is a fibrocartilagenous, tubular structure, ranging between 10 and 15 cm long in adults, extending from the cricoid cartilage to the bronchial bifurcation. It has an outer diameter of 2.5 cm. On transverse section, it is shaped like the letter *D,* with the straight portion posterior. Structurally, it consists of 18–24 *C*-shaped cartilages joined by fibroelastic tissue and closed posteriorly by a membranous structure consisting of nonstriated muscle, named the trachealis. One third of the trachea lies above the suprasternal notch and one third below. The isthmus of the thyroid gland usually lies over the 2nd and 3rd tracheal ring. Opinions vary about the preferred site of entering the trachea when performing a tracheotomy but the incision is usually made between the 2nd and 3rd or the 3rd and 4th tracheal ring where the isthmus of the thyroid is either displaced

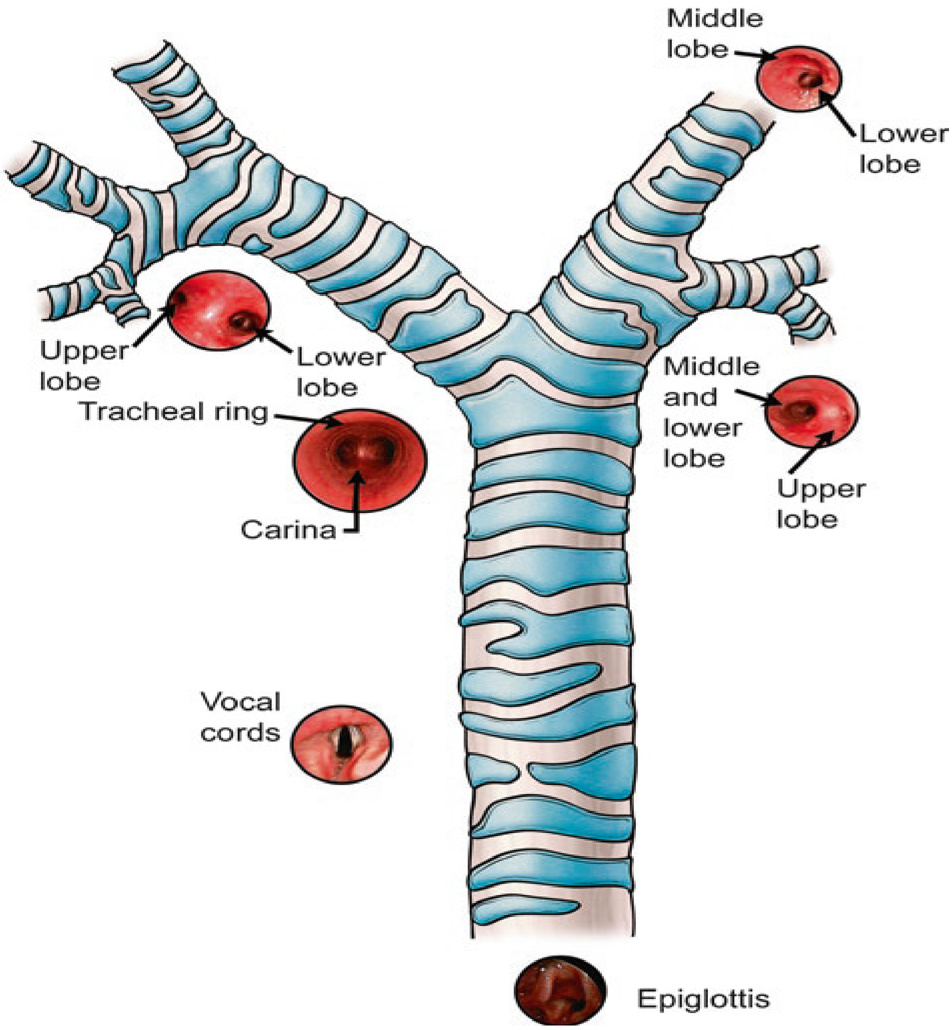


posterior cricoarytenoid muscles on the vocal cords



lateral cricoarytenoid muscles on the vocal cords

or divided at that level. The first ring of the trachea is never cut intentionally as tracheal stricture frequently occurs when incisions are made at that level.



Trachea

Bronchial Tree-Divisions

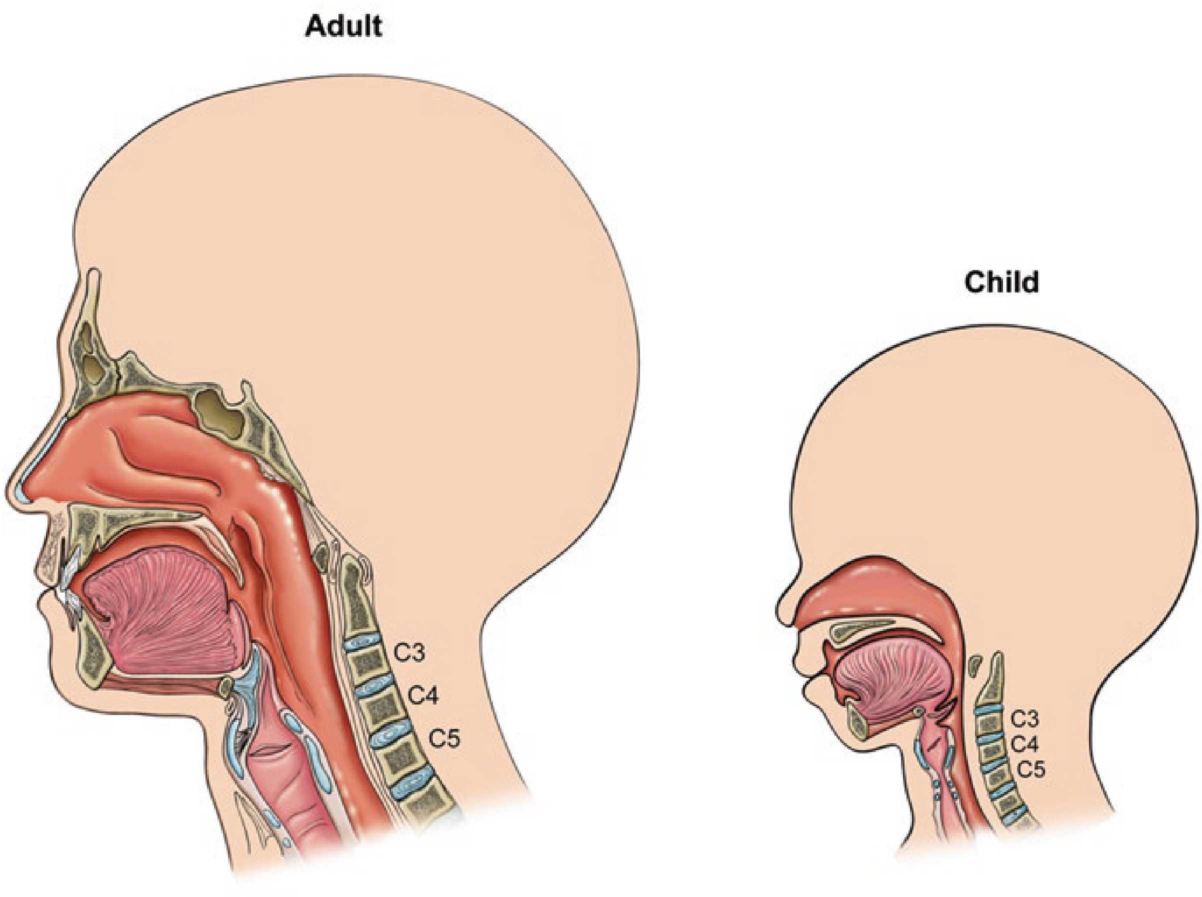
At about the level of the fifth thoracic vertebra, the trachea bifurcates into right and left main stem bronchi. The right mainstem bronchus appears (more than the left) to be a vertical continuation of the trachea; furthermore, the right upper lobe bronchus has its origin about 2 cm from the carina, compared to the left, which arises about 5 cm from the carina. For these reasons, aspiration of food, liquids, or foreign bodies is far more likely to occur on the right side, and right main stem intubations are far more common than left.

From this illustration, one can see the initial branching-off of the tracheobronchial tree and includes a fiberoptic view of the larynx, trachea, mainstem bronchi and first division of the mainstem bronchi and photographs the entry into the various subdivisions of the bronchi. The right upper lobe bronchus (RUB) leaves the main stem, pointing in a lateral direction (3 o'clock), measures about 2 cm and gives off three branches: anterior, apical, and posterior. Bronchus intermedius extends from the lower end of the origin of the RUB to the take off of the middle lobe orifice which comes off bronchus intermedius, anteriorly
(12 o'clock).

It has two branches, lateral and medial. The right lower lobe bronchus is the continuation of bronchus intermedius and gives off five branches. The left main stem bronchus exits the trachea at an angle of about 40°. It divides into two main branches, left upper and left lower bronchi. The left upper bronchus divides into three subdivisions, apical, anterior and posterior and the left lower branch divides into superior and inferior lingular branches. The left lower lobe bronchus divides into five separate branches: superior, anterior basal, medial basal, lateral basal and posterior basal.

ADULT AND INFANT AIRWAYS COMPARISON

An adult is an individual aged 16 or older, a child is between the ages of 1 and 8, and an infant is 1 year of age or less. At age 8, the larynx of the child closely resembles that of an adult except in size. Any clinician involved in the management of airway problems should be cognizant of the infant airway. The differences between the adult and infant airway are not all explained by the age-associated changes in airway diameter (Fig. 1.24). There are differences in structure and function as well as size, involving the head, nose, tongue, epiglottis, larynx, cricoid, trachea, and mainstem bronchi.



Adult and infant airways-Comparision

Head

In proportion to the rest of the body, the infant's head is much larger than the adult's. This is significant in that, in the absence of muscle tone, the weight of the infant's head forces the cervical spine to assume a more flexed position, which tends to induce airway obstruction.

Nose

The infant's nostrils are smaller in relation to the trachea than are the adult's. It is interesting to note that the infant is a compulsive nose breather during most of the first year of life. However, this is a functional difference rather than an anatomical one.

Tongue

The infant's tongue is proportionately larger than that of the adult's. Lack of muscle tone in the tongue and mandible allow the tongue to "fall back," obstructing the flow of air during inspiration and expiration. Posterior displacement of the tongue is the most common cause of airway obstruction in infants (as well as in adults). Respiratory efforts in the presence of diminished muscle tone tend to pull the tongue in a ball valve-like fashion over the airway, further contributing to obstruction.

Larynx

The larynx is situated at a higher level in relation to the cervical spine in infants. 'At birth, the rima glottidis lies at the level of the interspace between the third and fourth cervical vertebrae. Upon reaching adulthood, it lies one vertebra lower. The infant's vocal cords are concave and have an anteroinferior incline. In adults, the vocal cords are less concave and lie more horizontally.

Cricoid Cartilage

The airway of the infant is narrowest at the level of the cricoid cartilage. In contrast, the adult airway is narrowest at the rima glottidis.

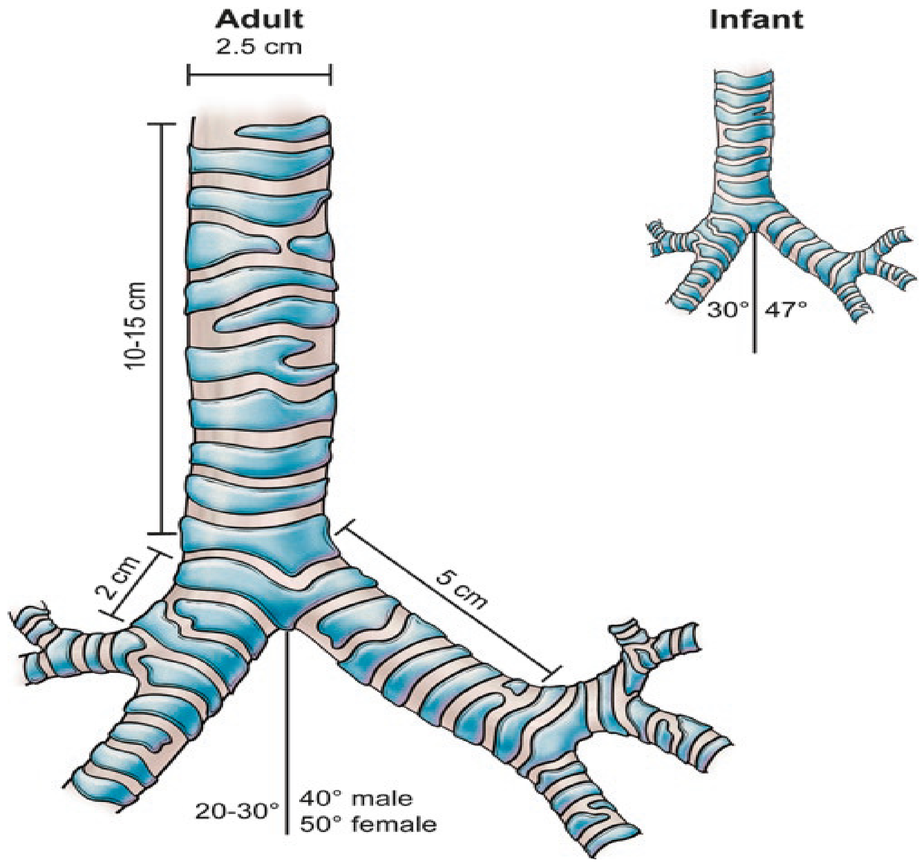
Epiglottis

The epiglottis in infants is remarkably different from that in adults. It is relatively longer, more omega shaped (W), and less flexible. In infants, the hyoid bone is firmly attached to the thyroid cartilage and tends to push the base of the tongue and epiglottis toward the pharyngeal cavity; consequently, the epiglottis has a much more horizontal lie than in adults.

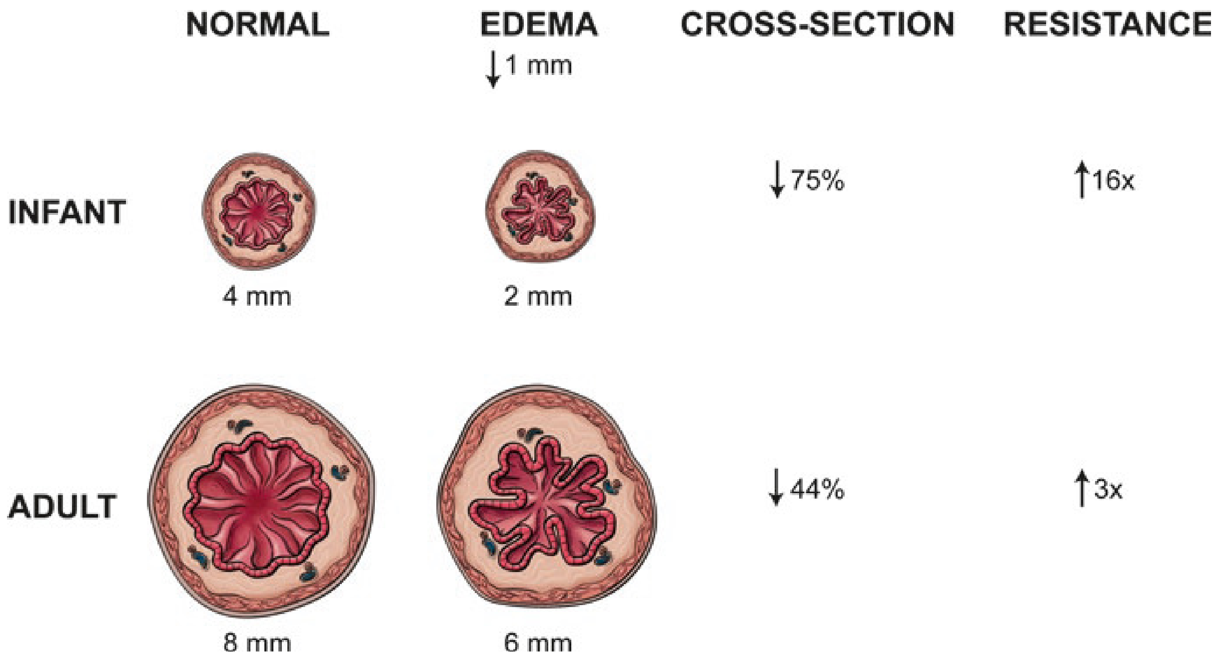
Trachea and Mainstem Bronchi

The major conducting airways are both narrower and shorter in infants, leaving less room for error in positioning endotracheal tubes. The trachea of a premature infant may be as short as 2.0 cm. In infants, the bifurcation of the trachea (into right and left mainstem bronchi) projects at an angle of about 30° from the tracheal axis, whereas the left mainstem bronchus projects at an angle of about 47°. In adults, the angle between the right mainstem bronchus and tracheal axis is more acute. Endotracheal tubes inserted too far into the trachea are more likely to enter the right mainstem bronchus than the left in both adults and infants. The salient anatomical differences between the infant and adult airways are summarized as follows. The infant's larynx is situated at a much higher level than the adult's. The infant's tongue is relatively larger, and the epiglottis is omega shaped, longer, and stiffer. The narrowest part of the infant's laryngeal airway is at the level of the cricoid cartilage, whereas that of the adult is at the rima glottidis. In infants, the right mainstem bronchus is less vertical than in adults.

The most significant difference between the adult larynx and the infant larynx is that the overall diameter of the adult's airway is 10–12 mm wider than that of a newborn. If the internal diameter of a neonate's larynx measures 4 mm at the level of the cricoid cartilage, a 1-mm circumferential reduction in this diameter (caused by either trauma or infection) will reduce the overall cross-sectional area of the airway by approximately 75%. A similar reduction in the diameter of the adult airway will reduce the cross-sectional area by about 44%.



Adult and infant tracheobronchial trees

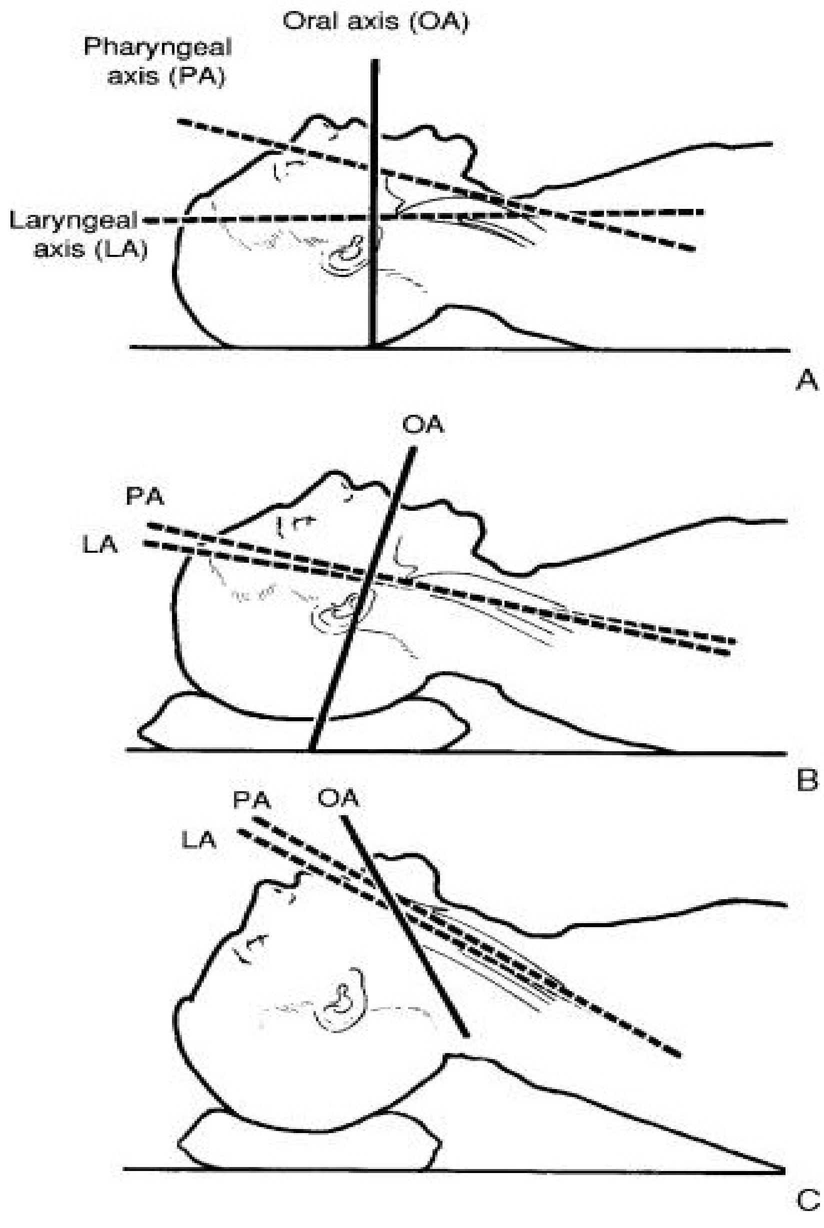


Effects of edema in the adult and infant airway

ENDOTRACHEAL INTUBATION

The upper airway has 3 visual axes. They are the long axes of the mouth, oropharynx, and larynx. In order to bring all 3 axes into better alignment, McGill suggested the" "**sniffing the morning air"20** position

SNIFFING POSITION



The true sniffing position has two components—cervical flexion and atlantooccipital extension. Cervical flexion approximates the pharyngeal and laryngeal axes. Atlanto-occipital extension brings the oral axis into better alignment with the other two. Normal atlanto-occipital extension measures 35 degrees. With optimal alignment of the airway's visual axes, it becomes possible to look through the airway into the laryngeal opening. Inability to assume the sniffing position is a predictor of difficult intubation. Examples of problems that prevent the sniffing position are cervical vertebral arthritis, cervical ankylosing spondylitis, unstable cervical fractures, protruding cervical discs, atlantoaxial subluxation, cervical fusions, cervical collars, and halo frames. Morbidly obese patients sometimes have posterior neck fat pads that prevent atlanto-occipital extension.

Tracheal Intubation

Tracheal intubation (insertion of the tracheal tube) is an essential skill in anaesthetic practice. Indications for tracheal intubation are shown in Box.
There are no absolute contraindications to tracheal intubation.

Indications for tracheal intubation

Surgical and Anaesthetic Indications

Surgical requirement for neuromuscular blocking drugs, e.g., abdominal surgery.

Airway access shared with the surgeon, including ear, nose, and throat surgery.

Patient position in which access to the airway is restricted or precludes rapid tracheal intubation, e.g., lateral, prone.

Predicted difficult airway.

Risk of aspiration of gastric contents or blood, e.g., upper gastrointestinal obstruction or sepsis, facial trauma, bleeding into the respiratory tract from any cause.

Surgery that impairs gas exchange

Prolonged surgery

Other airway techniques ineffective.

Critical Illness

Inability to protect the airway, e.g., coma from any cause

Impaired respiratory function (hypoxemia or hypercapnia) unresponsive to non-invasive management

Prevention of hypercapnia, e.g., raised intracranial pressure

DIFFICULT AIRWAY – DEFINITIONS

Difficult airway

The American Society Of Anesthesiologists (ASA) defined a difficult airway as “the clinical situation in which a conventionally trained anaesthesiologist experiences difficulty with mask ventilation, difficulty with tracheal intubation or both .

Difficult facemask ventilation

Defined initially by the ASA as the inability to maintain oxygen saturations >90% with 100% oxygen by facemask (if saturations were above this value before induction of anaesthesia) or to reverse signs of inadequate ventilation.

Difficult laryngoscopy

The updated ASA practice guidelines in 2003 suggested that difficult direct laryngoscopy is when ‘it is not possible to visualize any portion of the vocal cords after multiple attempts at conventional laryngoscopy

Difficult intubation

Tracheal intubation may be difficult because of failure to see the glottis by line-of-sight, or due to laryngeal or tracheal distortion or narrowing. Difficult tracheal intubation is when ‘tracheal intubation requires multiple attempts in The presence or absence of tracheal pathology.

Time taken to achieve intubation

The original ASA definition of difficult intubation included a time limit of 10 minutes, a time limit which must include repeated facemask ventilation”.

Number of attempts

The ASA originally defined difficult intubation as ‘requirement for more than three attempts at intubation by direct laryngoscopy’ (or more than 10 minutes).

PREDICTORS OF DIFFICULT INTUBATION

MOUTH OPENING

Mouth opening is important because it determines the available space forplacing and manipulating laryngoscopes as well as tracheal tubes. Mouth opening also provides room to see through the uppermost part of the airway.

The adequacy of mouth opening is assessed by measuring the inter-incisor distance. An inter-incisor distance of 3 cm provides sufficient space for intubation, absent other complicating factors. This corresponds approximately to two finger breadths. The two finger breadth test is performed by placing the examiner's second and third digits between the patient's central incisors. If they fit, there should be adequate room to perform laryngoscopy. If they do not fit, laryngoscopy may be difficult.

Factors that interfere with mouth opening include masseter muscle spasm, TMJ dysfunction, and various integumentary aliments. Skin problems that adversely affect mouth opening include burn scar contractures and progressive systemic sclerosis.

DENTITION

Instrumentation of the airway places teeth at risk for damage. Teeth may be dislodged or broken. Broken teeth can fall into the trachea, migrate to the lung, and predispose to abscesses. Prominent maxillary incisors complicate laryngoscopy by protruding into the mouth and block the line of sight to the larynx.

TONGUE

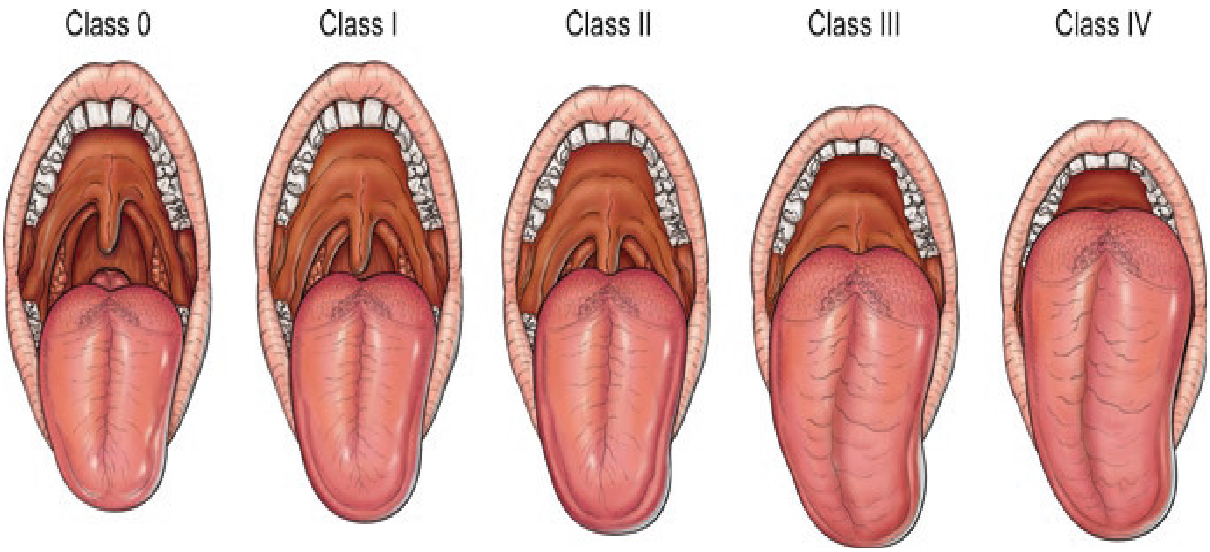
The tongue occupies space in the mouth and oropharynx. The base of tongue resides close to the glottic aperture. Visualizing the larynx requires displacing the base of tongue anteriorly so that the line of sight to the glottis is restored. The tongue is frequently displaced with a hand-held rigid laryngoscope. Large tongue (macroglossia) and small mandible (micrognathia) are predictors of difficult intubation.

Mallampati classification

Mallampati and colleagues in 1985 and Samsoon and Young in 1987 devised classificationsystems to predict difficult laryngoscopy. The patient is seated in the neutral position. He is asked to open mouth as wide as possible and the tongue is protruded as far as possible. Phonation is discouraged because it raises the soft palate and allows visualization of additional structures. The observer looks for specified anatomic landmarks. They are the fauces, pillars, uvula, and soft palate. The Mallampati classification system utilizes three groups and the Samsoon and young's classification system employs four groups. Both systems suggest that as the tongue size increases, fewer structures are visualized and laryngoscopy becomes more difficult.

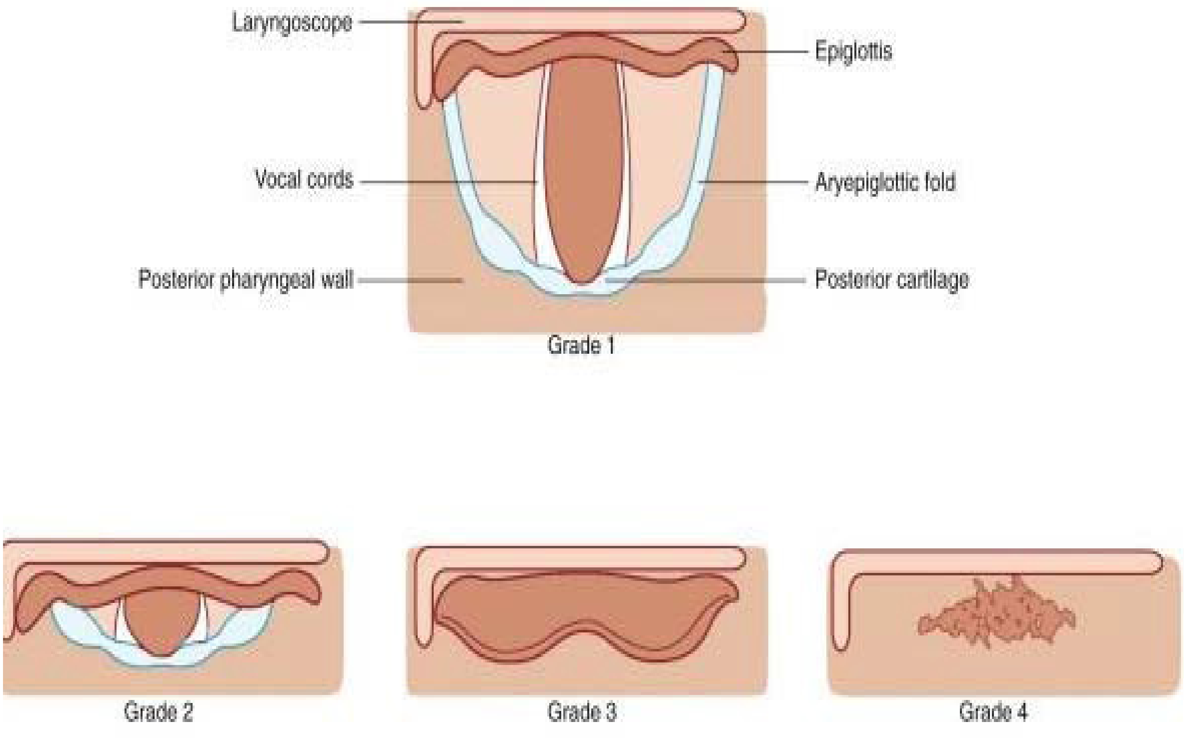
The Mallampati score estimates the size of the base of the tongue to predict difficult intubation. Because the tongue is the largest structure in the mouth, its size might partly affect the ease of direct laryngoscopy.

Samsoon and Young's modification of Mallampati classification



Pharyngeal structures- Classification

- I- pillars,uvula,fauces,soft palate
- II- fauces,uvula,soft palate
- III- uvular base,soft palate
- IV- Hard palate



Grade 1-entire laryngeal aperture seen

Grade 2-posterior part of the laryngeal aperture seen

Grade 3-epiglottis only visible

Grade 4-even epiglottis not visible

Thyromental 28 or sternomental distance

Limits below which the tests are suggested to provide some prediction of difficult intubation are thyromental distance <6 cm and sternomental distance <13.5cm.

Group indices:

Wilson scoring system

Wilson risk	Score
Weight	
<90 kg	0
90–110 kg	1
>110 kg	2
Head and neck movement	
>90 degrees	0
~90 degrees	1
<90 degrees	2
Jaw movement, jaw protrusion	
Incisor gap >5 cm, Class A	0
Incisor gap <5 cm, Class B	1
Incisor gap <5 cm, Class C	2
Receding mandible	
Normal	0
Moderate	1
Severe	2
Buck teeth	
Normal	0
Moderate	1
Severe	2

Patients scoring ≤5 have easy laryngoscopy, 6-7 moderate difficulty and those scoring 8-10 have severe difficulty during conventional laryngoscopy.

Arne's risk index, simplified score31

Factor	**Scoring**	**Points**
difficult intubation history	Yes	10
Pathologies associated with DI	Yes	5
Clinical symptoms	Yes	3
Thyromental distance	<6.5 cm	4
Head/neck movement	80–100	2
	<80	5
Mallampati	Class 2	2
	Class 3	6
	Class 4	8
Mouth opening, jaw protrusion	3.5–5.0 cm, B	3
	<3.5 cm, C	13

Arne's score of > 11 is predictive of difficult tracheal intubation

Rapid airway assessment

In an emergency situation, 1-2-3finger assessment test may be rapidly performed to assess TMJ function, mouth opening and mandibular space. This can be done in less than 15 seconds.

1-Finger test- Place the index finger in front of tragus and ask the patient to open hismouth wide. As the condyle of mandible slides forward, the index finger in front of the tragus can be indented in this space.

2-Finger test- Ask the patient to open his mouth wide and place two fingers between teeth. If done this indicates space >3 cm and is adequate for 2 cm flange of direct laryngoscope.

3- Finger test- Ask the patient to extend his head and place 3 fingers between the chin and thyroid cartilage. If the distance is <6.5cm, it is an index of difficult intubation.

LEMON

Management course for use in a resuscitation room setting. This is a mnemonic where L= Look externally, E= Evaluate, M= Mallampati, O= Obstruction of airway and N= Neck movements.

Radiological indices

Lateral X ray of head and neck along with distance marking between bonylandmarks has been used to predict difficult laryngoscopy.

a) Ratio of effective mandibular length to its posterior depth that is less than 3.6 predicts difficult laryngoscopy/intubation
b) Reduced distance between occiput and the spinous process of C1of less than5mm predicts difficult laryngoscopy/intubation
c) An increase in the posterior depth of mandible of more than 2.5 cm poses problems during laryngoscopy/intubation

MRI

It has greatly improved the clinician's ability to diagnose complex airwaydisorders not ascertainable by the more routinely employed tests. Thus, sagittal MRI of the upper airways may be valuable in specialized cases.

DIFFICULT INTUBATION-PREDICTORS

Criteria	Suggestion of Difficult Intubation
History of difficult intubation	Present
Length of upper incisors	Relatively long
Inter-incisor distance	Less than two finger breadths or less than 3 cm
Overbite	Maxillary incisors override mandibular incisors
Temporo-mandibular joint translation	Inability to extend mandibular incisors anterior to maxillary incisors
Mandibular space	Small, indurated, encroached upon by mass
Cervical vertebral range of motion	Cannot touch chin to chest or cannot extend neck
Thyromental distance	Less than three finger breadths (less than 6 cm)
Mallampati-Samsoon classification	Mallampati III/Samsoon 4—relatively large tongue, uvula not visible
Neck	Short, thick

Technique of Orotracheal Intubation

The long axis of the Macintosh laryngoscope is curved, the cross section is a right-angled "Z" section, the web and flange are bulky, the tip is a traumatic, and the light bulb is shielded by the web.

Tracheal intubation is normally achieved with a rapid sequence of maneuvers in which all components of a complex technique merge into one another. The three component steps of direct laryngoscopy are insertion of the laryngoscope, adjustment of its position and lifting force, and use of other maneuvers to optimize the view of the glottis.

The "sniffing the morning air" position is used. Full mouth opening facilitates insertion of the laryngoscope. It is inserted from the right side of mouth and to the right of the tongue while taking care to not trap the lips between the laryngoscope blade and the teeth. The laryngoscope is advanced and simultaneously moved into the midline to displace the tongue to the left. Progressive visualization of anatomic structures minimizes the risk of trauma. The epiglottis is the first key anatomic landmark. The tip of the laryngoscope is advanced into the vallecula, and the epiglottis is elevated indirectly by applying a force that tensions the hyoepiglottic ligament. Elevation of the epiglottis is optimized and a further lifting force is applied to the laryngoscope to achieve the best view of the larynx. It is very important not to lever on the maxillary teeth because this may cause dental damage and reduce the view of the larynx.

Once the vocal cords are visualized the endotracheal tube is negotiated through the vocal cords.

Principles of Clinical Practice of Tracheal Intubation

The incidence of complications should be minimized by using best practice28. Adequate personnel, drugs and equipment must be available. Four principles are central to prevention of complication:

1. Maintenance of oxygenation must take priority over all other issues. Preoxygenation should be performed before induction of anesthesia.28 Mask ventilation should be used between attempts at tracheal intubation.
2. Trauma must be prevented. The first attempt at tracheal intubation should be performed under optimal conditions (including patient position, pre-oxygenation, and equipment preparation). The number of attempts with blind techniques should ideally be zero and certainly not more than four.
3. The anaesthesiologist should have backup plans before starting the primary technique and the skills and equipment needed to execute these plans. When unanticipated difficulty occurs in non-lifesaving surgery, the safest plan is to terminate attempts at tracheal intubation, awaken the patient, and postpone Surgery.
4. The anaesthesiologist should "call for help" as soon as difficulty with tracheal intubation is experienced. Intravenous access is secured

(occasionally achieved only during inhaled induction of anaesthesia) and standard monitoring is established. The patient should be in the optimal position. Time spent adjusting the position after induction of anaesthesia may delay successful tracheal intubation, prolong the time at risk for pulmonary aspiration, and increase the risk for hypoxemia or airway trauma.

Several studies have demonstrated improved outcome in severely ill and injured patients if the airway is successfully secured early by tracheal intubation. , the occurrence of difficulties and/or failure to successfully intubate the trachea constitutes an important cause of morbidity in the pre-hospital setting. Tracheal intubation is frequently difficult to perform and associated with a lower success rate in this challenging environment. The need for repeated attempts to secure the airway emergently increases airway-related complications such as hypoxia, pulmonary aspiration and adverse haemodynamic events. Of particular concern, accidental oesophageal intubation in emergency situations outside the operating room results in high incidences of severe hypoxemia, regurgitation and pulmonary aspiration of gastric contents, cardiac dysrythmias and cardiac arrest. Difficulties in tracheal intubation may also result in severe local complications such as perforation of laryngeal or pharyngeal structures.

Signs Indicative of an Abnormal Airway

1. Trauma, deformity; burns, radiation therapy, infection, swelling; hematoma of the face, mouth, pharynx, larynx, and/or neck

2. Stridor or "air hunger"

3. Hoarseness or "underwater" voice

4. Intolerance of the supine position

5. Mandibular abnormality:

    (a) Decreased mobility or inability to open the mouth at least three finger-breadths

    (b) Micrognathia, receding chin:

    (i) Treacher Collins, Pierre Robin, other syndromes

    (ii) Less than 6 cm (three finger-breadths) from tip of the mandible to thyroid notch with neck in full extension (adolescents and adults)

    (c) Less than 9 cm from angle of the jaw to symphysis

    (d) Increased anterior or posterior mandibular depth

6. Laryngeal abnormalities: fixation of the larynx to other structures of neck, hyoid, or floor of mouth

7. Macroglossia

8. Deep, narrow, high-arched oropharynx

9. Protruding teeth

10. Mallampati/Samsoon classes III and IV (see Figs. 5.6 and 5.7); inability to visualize the posterior oropharyngeal structures (tonsillar fossae, pillars,

uvula) on voluntary protrusion of the tongue with mouth wide open and the patient seated

11. Neck abnormalities:

    (a) Short and thick

    (b) Decreased range of motion (arthritis, spondylitis, disk disease)

    (c) Fracture (possibility of subluxation)

    (d) Obvious trauma

12. Thoracoabdominal abnormalities:

    (a) Kyphoscoliosis

    (b) Prominent chest or large breasts

    (c) Morbid obesity

    (d) Term or near-term pregnancy

13. Age between 40 and 59 years

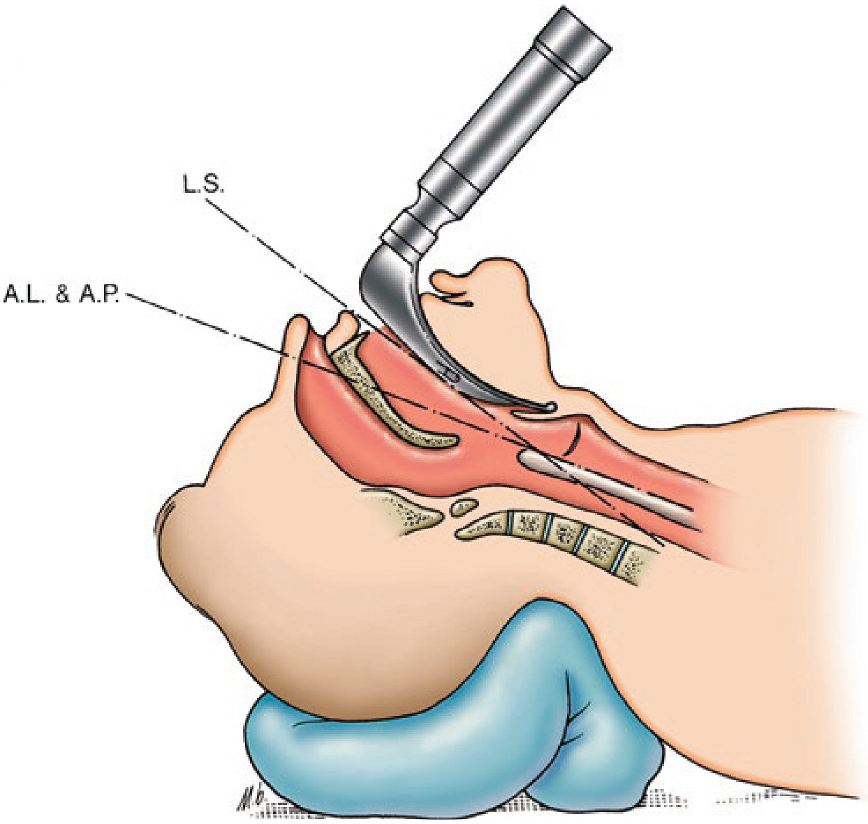
14. Gender (male)

15. Snoring and sleep apnea syndrome.

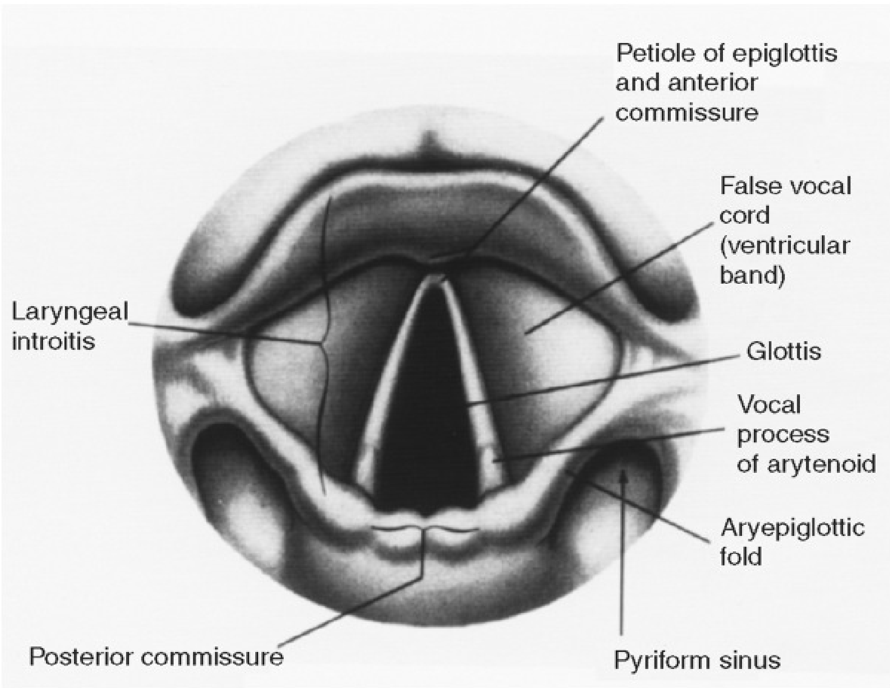
Maneuvers Used to Optimize the View at Direct Laryngoscopy

- Maximum head extension
- Tongue entirely to the left of the laryngoscope
- Optimal depth of insertion of the laryngoscope
- Strong lifting force applied in the correct direction to the laryngoscope
- External laryngeal manipulation—applied initially with the right hand of the Anaesthesiologist

View at direct laryngoscopy

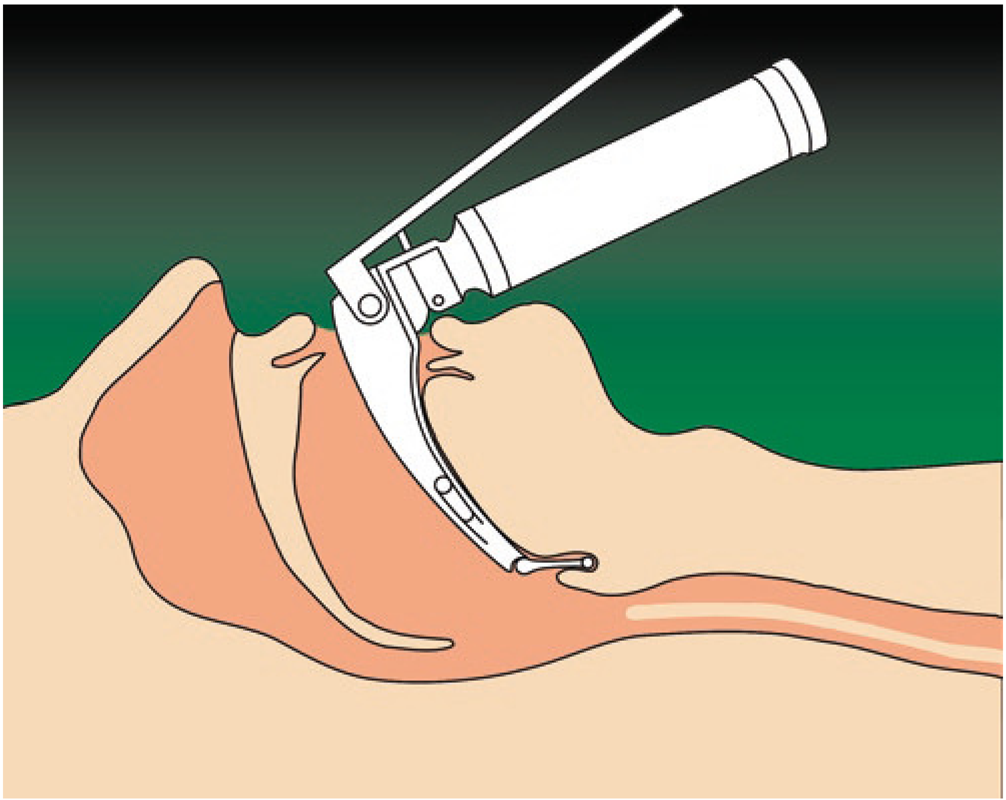


Vocal cords



MCCOY LEVERING LARYNGOSCOPE

The McCoy Levering Laryngoscope is one of the first levering laryngoscopes designed.



McCoy levering laryngoscope

Salient features

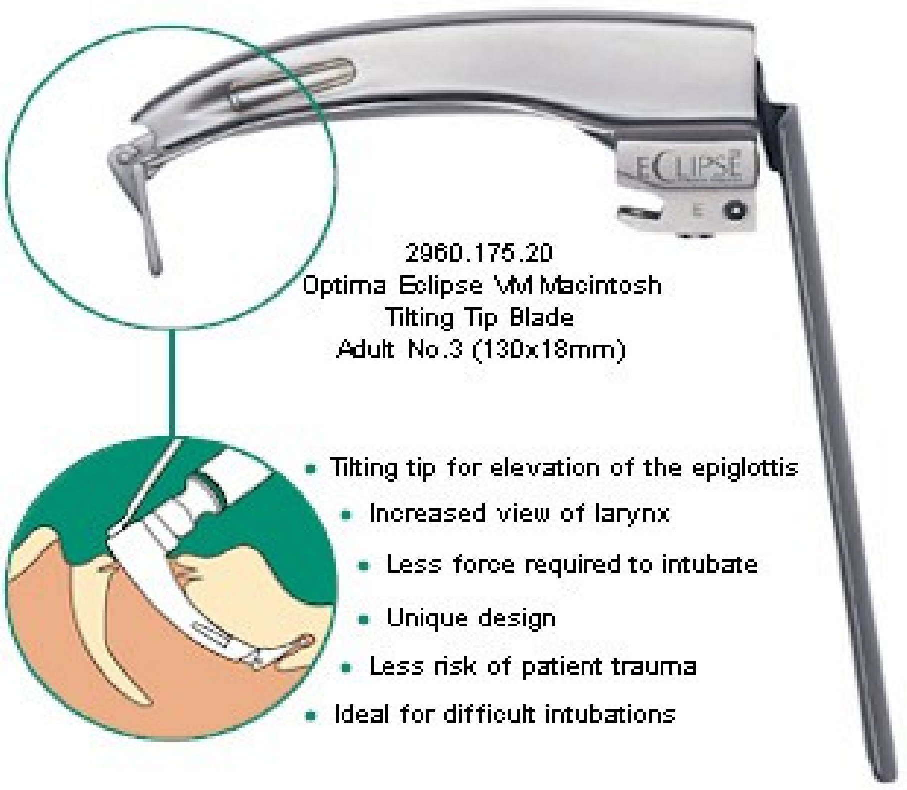
Tilting tip for elevation of epiglottis

Increased view of larynx

Less force required

Less risk of patient trauma

Ideal for difficult intubations



.

This is another modification (originally of the standard Macintosh blade) that enables you to have a good view of the vocal apparatus without the force often required when using the Macintosh blade in difficult situations. The blade is designed to eliminate contact with the upper teeth and to have its fulcrum at a lower point within the pharynx. Its tip is hinged, and the angle of the hinged portion can be altered by a lever attached to the handle.

The main advantage of this modification is improved visualization without altering the axis of the handle. In a small clinical trial involving about 50 patients with simulated difficult airways via neck immobilization in the neutral position, laryngoscopic views improved by one grade in 70% of patients with a grade 2 Cormack and Lehane view and 83% of patients with a grade 3

McCoy laryngoscope

view, compared with the view obtained with the standard Macintosh blade. The stress responses to laryngoscopy may be reduced when using the McCoy in comparison to the Macintosh blade, and pretreatment with opioids is not required when using this blade. Others report that the McCoy blade can be used to facilitate FOI even if the laryngoscopic view is not significantly improved. The reports of Randell et al. and Ochroch and Levitan suggest that laryngoscopic visualization is more improved by external tracheal manipulations ("B.U.R.P." maneuver) than by utilization of the McCoy scope placed in the "sniff position for elective intubation of patients. One case report by Usui et al. documents arytenoid dislocation in a patient intubated with a McCoy scope (this injury is also reported with standard blade designs).

The McCoy Laryngoscope is use full in conditions such as:

- Anteriorly placed Larynx
- Prominent upper teeth
- Tongue displaced backward
- Restricted neck movement
- Injuries to cervical spine
- Inadequate mouth opening
- Receding mandible

A disadvantage of using a lever to operate the blade tip is that the grip on the handle must be relaxed (at a time necessary for maximal stability and control) in order to use the thumb to depress the lever. Benham and Gale describe how the lever can be operated by a button mechanism attached to a secondary handle attached to the standard handle. Currently, this blade is manufactured with Macintosh designs for sizes 3 and 4 and Seward designs for sizes 1 and 2.

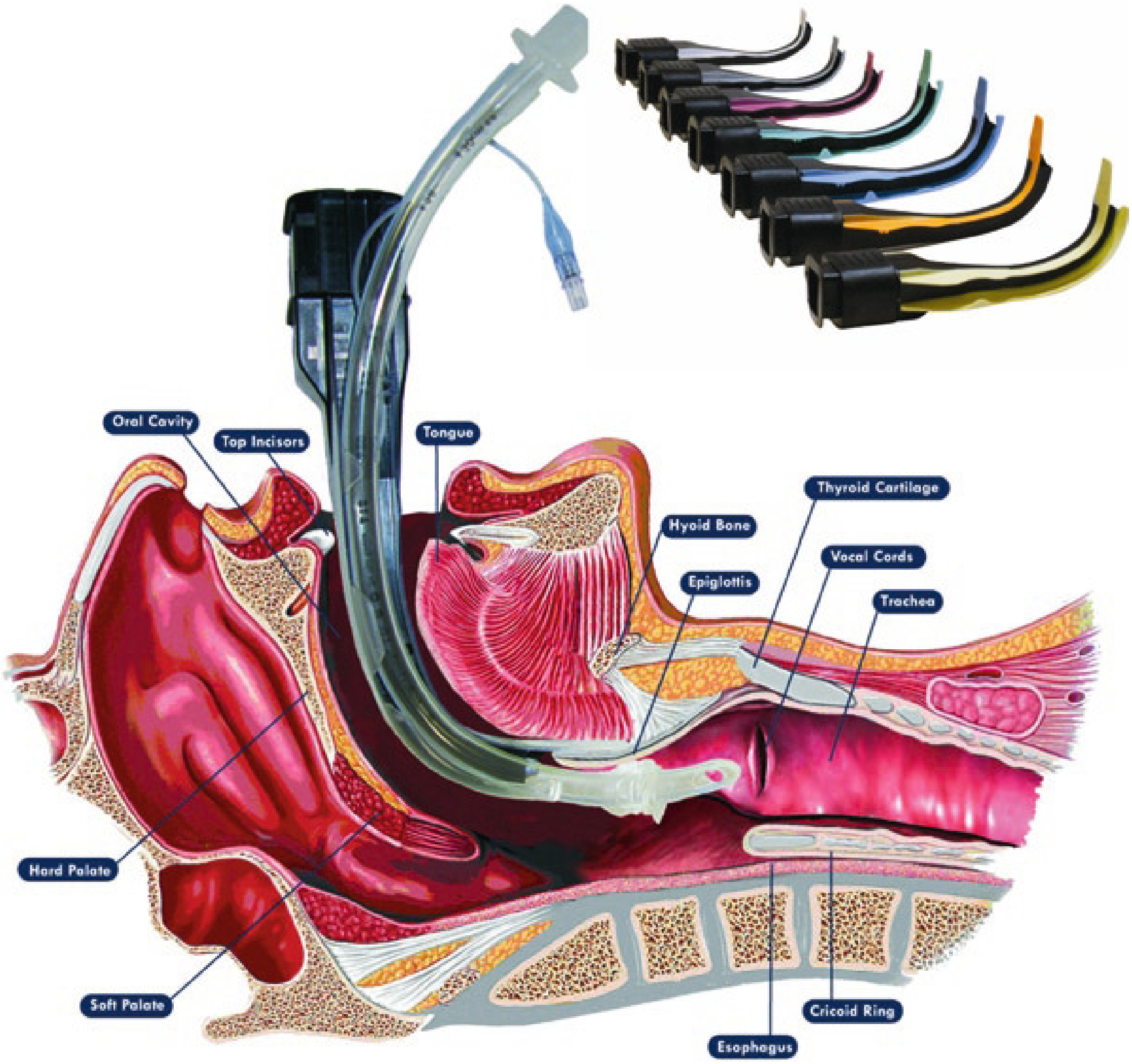
Pediatric McCoy

The pediatric version of the McCoy blade comes in a straight Seward style. A study comparing the pediatric McCoy (#1) with the conventional Miller (#1) blade for laryngoscopy and intubation of 40 normal infants found that the McCoy blade had no advantages over the Miller in laryngoscopy and may in fact delay intubation.

AIRTRAQ OPTICAL LARYNGOSCOPE

The Airtraq is an optical laryngoscope, somewhat similar to the AWS due to the two side by side channels within the blade, but the optics (contained in one of the channels) consist of a series of lenses, prisms, and mirrors that transfer the image from the tip to a viewfinder. . It offers:

- Full visualization of the airway, during 100% of the laryngoscopic procedure, facilitating tracheal intubation and avoiding esophageal and bronchial intubations
- No hyperextension of the neck required
- Allows intubation of patients in neutral position
- Easy to use
- Short learning cycle
- Versatile. Broad field of applications.



Airtraq optical laryngoscope

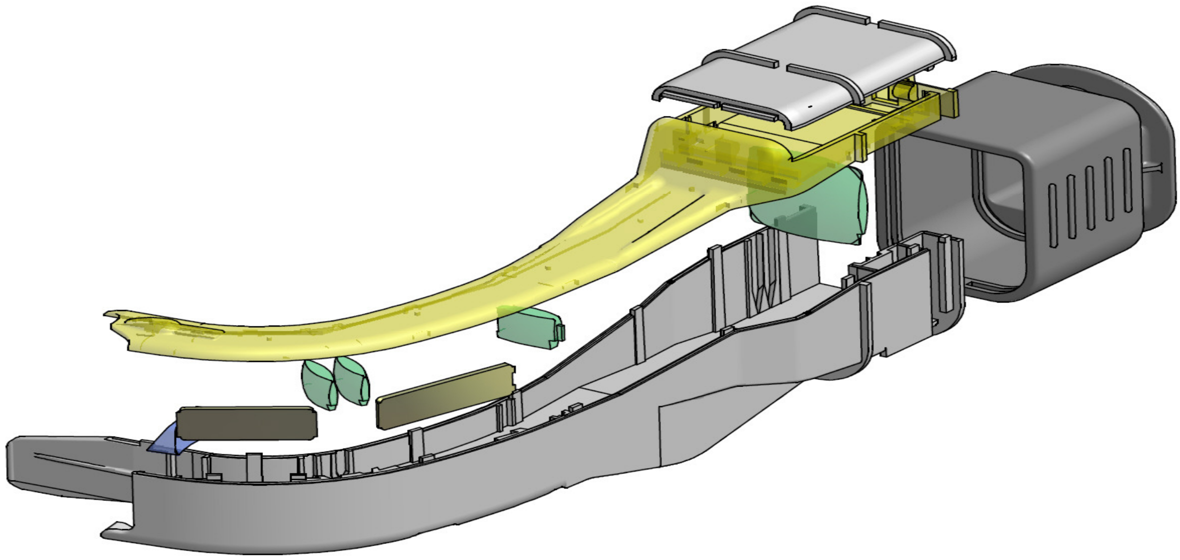
Airtraq Design Characteristics

- Anatomically shaped
- High quality optical system in separate visualization channel
- Guide channel for insertion of the endotracheal tube
- Anti-fog system for optics
- Light source (low temperature) for illuminating the anatomy
- Single use device
- Uses any standard endotracheal tube

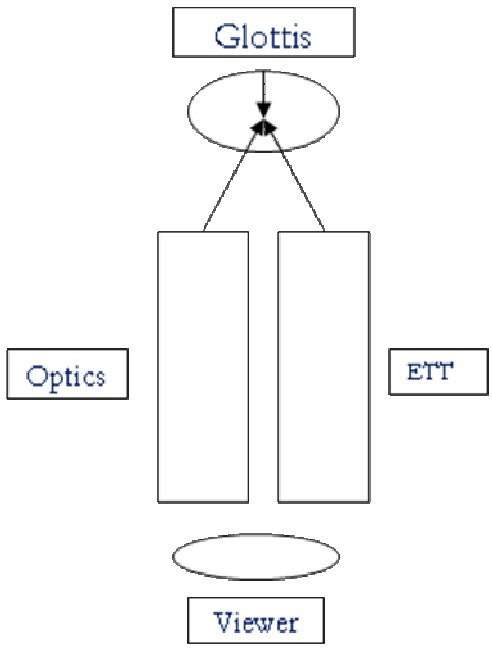
- Two sizes (plus paediatric in 2008).
- Available clip-on video system to allow viewing on an external screen .

Airtraq optical laryngoscope

Optics and View:



The "View"



- Optics and guiding channel "point" the user to the center of the viewing window.
- The user only has to center the vocal cords in the middle of the image and the ETT goes in.

How to select the appropriate Airtraq

- Works with any type of ETT
  - Standard
  - Reinforced (wired)
  - Pre-shaped
- Regular Size : Minimum mouth opening 18 mm
  - Can fit patients from 40 kg to 200 kg.
  - Can be used always that the mouth can open up to two fingers.
  - ETT sizes: 8.5 / 8.0 / 7.5 /7.0 (6.5/6.0) Up to 8.5
- Small Size : Minimum mouth opening 16 mm
  - First Choice for small adults or adolescents. Can fit patients from 25 kg to 100 kg.
  - ETT sizes: 7.5 / 7.0 / 6.5 / 6.0 Up to 7.5

The procedure uses a similar approach as the Macintosh blade, with the blade tip placed in the vallecula and enabling indirect lifting of the epiglottis when required. Tracheal intubation in patients without risk of difficulty was performed using the Airtraq, with similar success and insertion times to those performed using direct laryngoscopy with a Macintosh blade. In patients with either cervical spine immobilization or high risk for intubation difficulty (three or more risk factors), the Airtraq was superior to the Macintosh for speed of intubation attempts and intubation difficulty .All of the above studies found the Airtraq to cause less hemodynamic alterations than the Macintosh laryngoscope.

Morbidly obese patients, many of whom may have enlarged tongues, were more quickly intubated using the Airtraq than the Macintosh laryngoscope, and this device prevented similar reductions of arterial oxygen saturation. Moreover, a modified Airtraq has been used for awake tracheal intubation of an elderly woman with a history of regurgitation and difficult laryngoscopy. This device may be advantageous over conventional direct laryngoscopy in patients with cervical spine problems, since its use has shown to cause 29% less extension between the occiput and C4, and less anterior vertebral body deviation at most levels.Despite these values, significant movement was still seen during the procedure with the Airtraq. There have been reports of oropharyngeal injuries with the use of the Airtraq, potentially because of poor view of the initial insertion of the blade over the back of the tongue.

Using the Airtraq may improve performance or learning of intubation by novice laryngoscopists orpersonnel. Medical students with no prior airway management experience more quickly intubated manikins or intubation trainers, using fewermaneuvers and with less teeth clicks, in both easy and difficult airway scenarios when using the Airtraq compared to the Macintosh laryngoscope. In the difficult airway scenario particularly, they had greater success with intubation. Moreover, the students improved their performance with the Airtraq quickly. The Airtraq enabled nonanesthesiology physicians to more quickly secure the airways of patients and with fewer erroneous esophageal intubations than when they were using the Macintosh laryngoscope.

CERVICAL SPINE INJURY

Incidence and Etiology:

Cervical spine injuries occur in 1.5%-3% of all major trauma cases. Most victims are males ranging in age from 15 to 35 years. CSI is most frequently associated with accidents involving motor vehicles, diving, contact sports, riding horses, falls, and blunt head and neck trauma.The incidence of CSI due to blunt head trauma is 1.8%,and the incidence of CSI is higher among those with low Glasgow Coma Scores (e.g., initial scores below 8). Most patients with CSI have stable injuries. Injuries occur primarily at one of three levels of the cervical spine: C2, C6, or C7. Alert victims, devoid of neck pain and tenderness, numbness, or weakness in the arms or legs, should not require cervical spine evaluation or special precautions. Any victim who reports even the slightest symptom of neck discomfort or anyone who is not fully alert should have cervical spine precautions. Motor vehicle accidents with speeds in excess of 35 mph and accidents with a headfirst fall are considered higher risk than injuries from contact sports or nonheadfirst falls.

Pathophysiology

The goals of resuscitation should be stabilization of the cervicalspine, prevention of secondary injury, reduction of the fracture as soon as possible and protection of the spinal cord. The circulation of the spinal cord is more vulnerable to injury than that of the brain. Immediately following blunt trauma or compression, hemorrhages are seen in the central gray matter. A zone of hemorrhage, edema and necrosis spreads from the central area to involve, in severe injuries, the entire diameter of the cord within 6 to 24 hours. Damage to the gray matter involves only two or three segments at the level of injury. This will cause an interruption of nerve conduction in the fiber tracts, which isolates the region of the body below the level of injury from cerebral control.

There is progressive loss of function after the initial impact for the first 24 hours related to associated secondary injury, edema, disc compression, hematoma and hypoperfusion to the spinal cord. As edema sudsides or circulation is reestablished, the function in some areas may improve slightly; in the absence of further injury, the pattern is usually stable after the first day. The rest of the patients progress can be divided in an acute and chronic phase.

Acute phase (4-6 weeks)

The immediate response to spinal cord compression is a massive sympathetic stimulation and reflex parasympathetic activity that usually lasts for 3 to 4 minutes and is mediated by alpha-adrenergic receptors. The hemodynamic effects are severe hypertension and reflexe bradycardia or tachyarrhythmias. After this initial response, loss of neurologic function below the injured will cause what is called spinal shock. There is flaccid paralysis of voluntary muscles, areflexia, loss of sympathetic tone (hypotension and bradycardia in high thoracic or cervical injuries, increased vascular capacitance poikilothermia and flaccidity of the GI tract and the bladder with generalized ileus and urinary retention.

Treatment of cervical spine trauma begins with the realization that patients with head, neck, facial, and multiple injuries may also have cervical spine instability. In the hospital, lifethreatening situations are identified and treated during the initial and secondary surveys following theA,B,Cof trauma resuscitation. The rest of the resuscitation phase should focus on the prevention of secondary injuries to the spinal cord with early fracture stabilization and reduction, early ventilator support and adequate spinal perfusion (correction of hypotension). Recently, a multicenter trial has shown the usefulness of high dose steroids in the treatment of blunt spinal cord injuries. A bolus of methylprednisolone, 30 mg/kg, followed in 1 hour by an infusion of 5.4 mg/kg/hr for 23 hours, was associated with improvement in both sensory and motor recovery if started within 8 hours of trauma. Body temperature should be monitored at all times. Reflex vascular activity, sweating, and shivering are abolished in spinal shock; thus patients with high-level lesions are generally poikilothermic. Hyperglycemia which commonly occurs in patients with severe systemic stress, has been associated with worse neurologic outcome in animal studies. We recommend tight blood glucose control in the acute phase.

Chronic phase

Sympathetic tone returns to some extent in 4 to 7 days. Resting blood pressure returns to, or toward normal and there may be a mild hypertensive response (autonomic hyperreflexia) to various stimuli such as pain or bladder distention below the level of the lesion. Reflex activity returns after 4 to 6 weeks and the chronic phase begins. This is characterized by spastic motor the chronic phase begins. This is characterized by spastic motor paralysis with hyperactive tendon reflexes, occasionally severe autonomic hyperreflexia, and some return of involuntary bladder function.

A patient who sustains paralysis with no sign of distal sparing may have a complete and irreversible cord lesion. When the period of spinal shock is over, which is heralded by the return of the bulbocavernosus reflex (elicited by pulling on the glans penis, tapping the clitoris, or tugging on an indwelling urinary catheter and obtaining a rectal sphincter response), a definitive diagnosis can be made. If the reflex has returned and complete paralysis continues, there will be no neural recovery.

Two factors are particularly important to the anesthesiologist in the chronic phase: super sensitivity of cholinergic receptors and autonomic hyperreflexia.

cholinergic receptors supersensitivity

In response to denervation, cholinergic receptors proliferate beyond the end plates of voluntary muscle fibers, eventually to invest the entire cell Membrane. The muscle becomes supersensitive and contracts maximally in response to a concentration of acetylcholine only 10-4 to 10-5 that needed to initiate contraction in normal muscle. Potassium ion is released suddenly along the entire length of the fiber rather than gradually as the action potential propagates. This produces a rapid rise in serum potassium levels. Succinylcholine induces an identical response and may be associated with a serum potassium increase of 4 to 10 meq/L. The extent of this increase is roughly proportional The extent of this increase is roughly proportional to the amount of paralyzed muscle mass. Within 3 minutes of succinylcholine administration, the serum potassium reaches a peak and may cause irreversible ventricular dysrhythmias and cardiacarrest. Because of muscle supersensitivity, the severity of this reaction is virtually independant of the dose of succinylcholine administered. Hyperkalemia can be modified somewhat by prior administration of a non depolarizing muscle relaxant, paralyzing doses are required to eliminate it altogether. Super sensitivity becomes clinically significant within about a week following denervating injury and lasts for at least 6 months to 2 years. Thus, although succinylcholine is safe in the first days of paraplegia, it should be avoided completely after the third or fourth day.

Autonomic hyperreflexia

The chronic phase in which spinal reflexes reappear is characterized by autonomic hyperreflexia in a high proportion of patients. Cutaneous, proprioceptive, and visceral stimuli, such as urinary bladder distention, may cause violent muscle spasm and autonomic disturbances. The symptoms of autonomic hyperreflexia are facial tingling, nasal obstruction, severe headache, shortness of breath, nausea and blurred vision. The signs are hypertension, bradycardia, dysrhythmias, sweating, cutaneous vasodilation above and palor below the level of the spinal injury, and occasionally loss of consciousness and seizures. The precipitous blood pressure increase may lead to retinal, cerebral, or subarachnoid hemorrhage, increased myocardial work and pulmonary edema. Patients with chronic spinal cord lesions above T-6 are particularly at risk for this response: 85 % will display autonomic hyperreflexia at some time during the course of daily living. Of course, surgery is a potent stimulus to autonomic response even in patients who give no history of the problem. The pathway of this syndrome may present in the bodyfor a long time . Afferent impulses enter the isolated spinal cord and elicit reflex autonomic output over the entire sympathetic outflow below the level of injury, which is not modulated by higher centers as in the neurologically intact subject. This causes vasoconstriction below the level of injury and resultant hypertension, which stimulates baroreceptors and may cause bradycardia via intact vagal pathways to the heart and vasodilation viaintact pathways above the injury.

Therapeutic methods to reduce the hypertension of autonomic hyperreflexia must act below the level of injury. Ganglionic blockers, alpha-adrenergic blockers, catecholamine depleters, direct vasodilators, and general or regional anesthesia have been recommended for prevention or treatment of autonomic hyperreflexia.

Management

The trauma victim's neck should be immobilized as soon as possible after injury and remain so until neck injury has been excluded or definitive management forCSI has been initiated. Despite this, prolonged immobilization especially in patients of low risk for CSI, is costly and may itself pose a risk to the patient. The most reliable method of immobilizing the neck is to secure the victim on a hard board. If possible, a rigid collar is placed around the neck with sandbags at each side. These measures will reduce movement significantly, though not completely. All airway maneuvers, including cricoid pressure, widen the disc space to some degree. When performing intubation using direct laryngoscopy, the view obtained may be improved when using manual in-line immobilization rather than collarsbecause of improved mouth opening.

If there is a need for rapid airway establishment and oxygenation in the CSI patient, the Combitube may be very useful. Flexion of the neck is not required, so that this device can be safely inserted in these patients. Patients with unstable C1C2 fractures seem most vulnerable to neurological damage from intubation. Despite the potential for serious neurological deficit during airway manipulation, the actual incidence is extremely rare. Few reports have appeared dealing with serious injury after intubation and they are rarely published.

The patient is at greatest risk of neurological injury when CSI is not recognized. Reid et al. found that new neurological deficits were 7.5 times more common if an injury went unrecognized. It is important to remember that up to 8% of C-spine fractures are not recognized radiologically, even when three views are taken. Radiological clearance may give a false sense of security. In one study involving 128 patients with suspected CSI, both the senior radiologist and emergency medicine physician missed the diagnosis of CSI in 25% of cases. It has been suggested that the anesthesiologist should be able to read the ABCs of cervical spine films as well. This interpretation requires knowledge of the alignment of the vertebrae, the condition of the bones and cartilage, and the width of the soft tissue and intervertebral spaces. Therefore, when obtaining a history, even if there is only the remotest hint of neck injury, handle the patient with extreme care if airway manipulation is required. In managing CSI patients, clinicians must carefully address both cervical spine clearance and airway management techniques.

Cervical Spine Clearance

While radiological study is often performed for trauma patients suspected of having CSI, the use of radiological assessment in asymptomatic patients (approximately one-third of trauma patients) has been raised. According to the National Emergency X-Radiography Utilization Study (NEXUS) low risk criteria, patients who are asymptomatic include those who meet all of the following: are neurologically normal, not intoxicated, do not have neck pain or midline tenderness, and do not have an associated injury that is distracting to the patient.

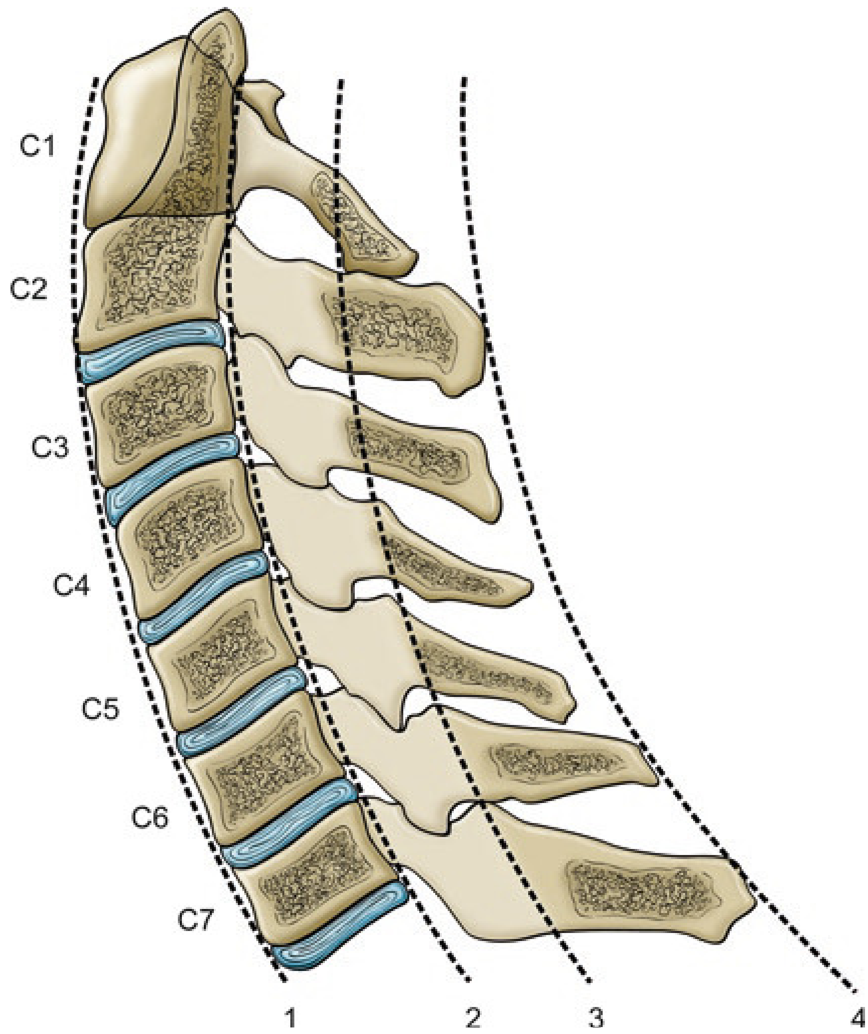
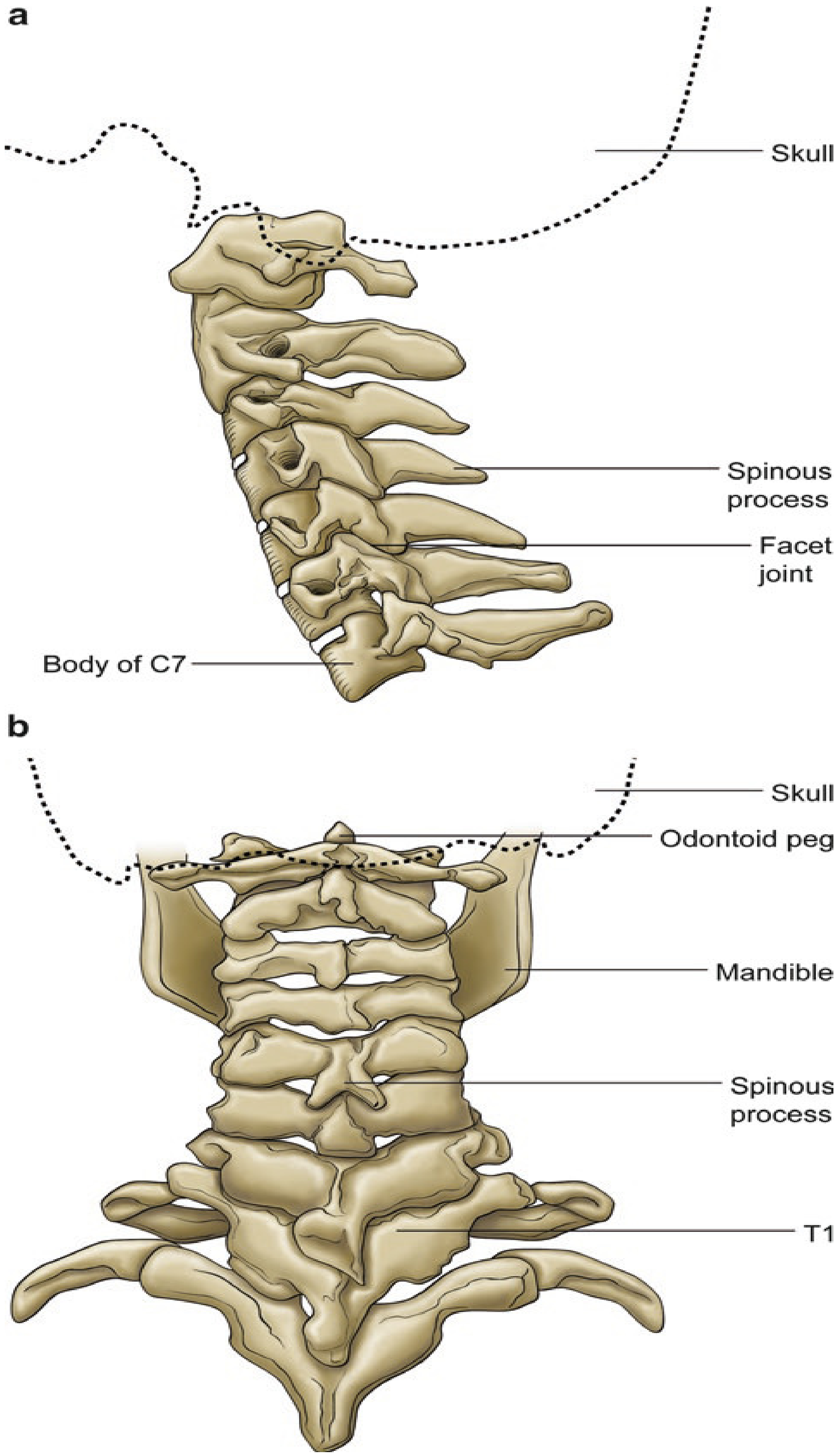


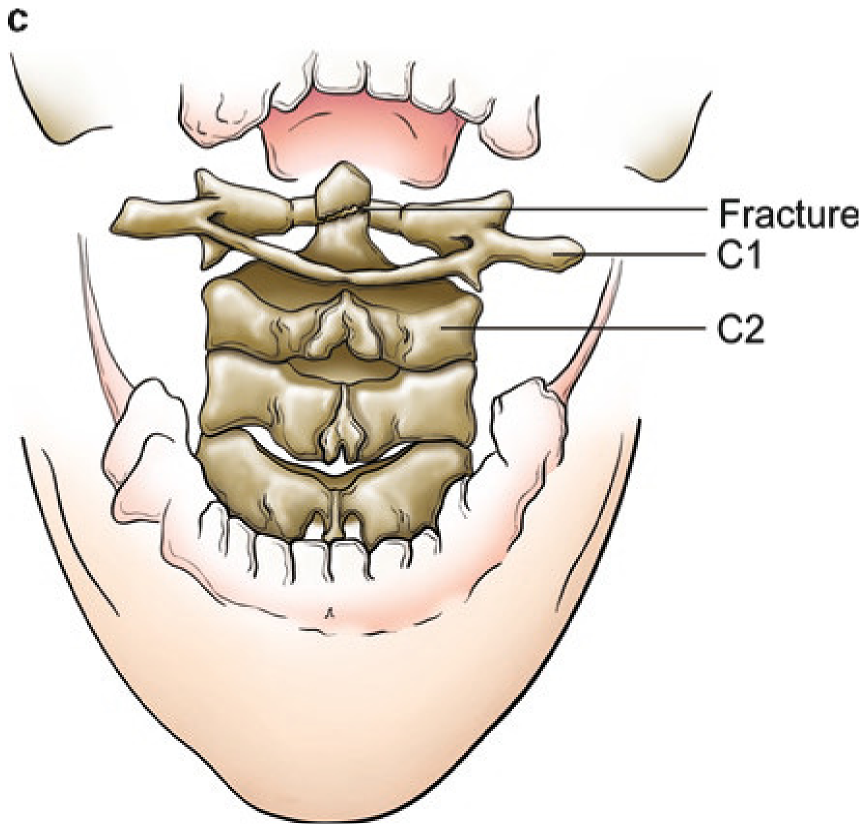
Diagram of the lateral view of the cervical spine demonstrating normal alignment. Lines drawn through the anterior (*1*) and posterior (*2*) margins of the vertebral border, the junction between the lamina and spinous processes (*3*), and the tips of the spinous processes (*4*) should be smooth curves. Lines (*2*) and (*3*) are the approximate boundaries of the spinal canal

Patients who present with significant facial trauma, brain injury and/or with multiple injuries will be hard to clear through clinical findings. A three-view clinical series (anteroposterior, lateral, and open-mouth odontoid peg) of which all seven vertebrae are visible is usually recommended for patients who are symptomatic after traumatic injury, although these views may only identify about 90% of cervical spine injuries.



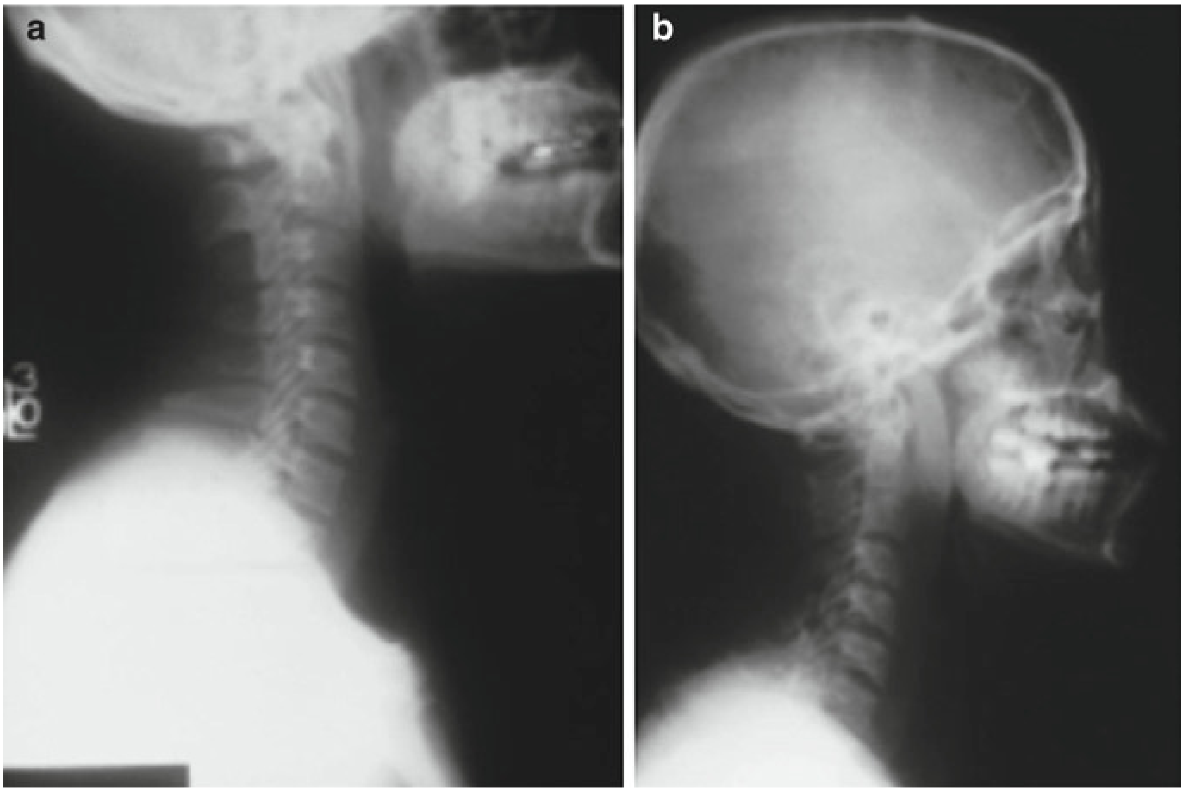
Cervical spine line drawings. (**a**) Lateral, (**b**) anterior–posterior, (**c**) through-the-mouthShowing C1, C2

Several imaging techniques (i.e., MRI and dynamic fluoroscopy) have been used for diagnosing ligamentous injury, although these are not routinely performed.



Continued

In each patient, clearance will depend on a risk–benefit decision, considering the likelihood of spinal injury and the morbidity and mortality associated with prolonged immobility.



Cervical spine soft tissue films. (**a**) Normal with cervical prevertebral soft tissue. (**b**) Abnormal swelling of cervical prevertebral soft tissue

Airway Management

Airway management in the presence of CSI is often a challenging prospect. In emergency situations, the clinician may be forced to intervene without information about the cervical spine. It has been demonstrated over and over again that intubation even in the presence of CSI is safe – provided proper precautions are taken, which include in-line stabilization (without traction forces) and appropriate caution during laryngoscopy.

There is no published evidence regarding the superiority of any one intubation option, yet there are recommendations and standards of care that are followed to a large extent. Intuitively, it would appear that awake fiberoptically assisted oral or nasal intubation is the ideal method because head or neck movement is limited. Furthermore, in patients who are not overly sedated, neurological assessment can be performed after intubation using awake techniques.

In emergency situations, direct laryngoscopy may be heavily relied upon. There may be less cervical manipulation with the use of the McCoy laryngoscope blade and bougie. The use of standard or intubating LMAs may produce posterior displacement of the upper cervical spine, although the clinical relevance of this has notbeen determined.

Surgical cricothyrotomy is an option if nasal or oral routes cannot be used or are unsuccessful. The relative safety of various airway intervention techniques cannot be studied easily. Since the incidence of neurologic deterioration after any intervention is so rare, an overwhelming number of subjects would need to be studied.

The most important consideration is that the anesthesiologist secures the airway using the most familiar techniques. Having limited skills with the bronchoscope will preclude safe and successful awake fiberoptic intubation regardless of prevailing opinions of its merit. There is no room for dogma in dealing with these cases. Direct laryngoscopy is perfectly safe provided reasonable precautions are taken, including appropriate spine immobilization. Awake intubation may be dangerous in an uncooperative patient or one who is semicomatose. There is a suggestion that neck muscles act as a splint in the awake state and this is lost when general anesthesia is used with muscle relaxants.

A difficult intubation in the presence of CSI is probably the ultimate airway challenge faced by anesthesiologists. Cricothyrotomy is an obvious option, while tracheostomy generally is considered inappropriate in the emergency setting. Retrograde catheter-assisted techniques may also help. TTJV is valuable in desperate situations, but it does not protect the airway against aspiration. The laryngeal mask may also be a useful temporizing measure in some cases. Training with the insertion of the LMA will be essential to avoid cervical movement.

In summary, CSIs present some unique challenges. No one technique of airway management appears to be any better than another. In view of the multiple disciplines involved, it would make sense to establish clinical guidelines for optimal management of these cases.

REVIEW OF LITERATURE:

In a study titled “Comparison of tracheal intubation using the Airtraq and Mc Coy laryngoscope in the presence of rigid cervical collar simulating cervical immobilization for traumatic cervical spine injury”, A randomized cross over study was under taken in 60 ASA I and ASA II patients using Mc Coy laryngoscope and Airtraq.The mean intubation time was 33.27sec for laryngoscopy and 28.95 sec for Airtraq(p-0.32).The median Cormack-Lehane glottic view Grade was 3 and 1 forMc Coy laryngoscopy and Airtraq(p-0.003).They concluded that usingAirtraq improved the ease of intubation significantly when compared to McCoy blade.[1]

A study titled “Tracheal intubation in patients with rigid collar immobilization of the cervical spine” was conducted to evaluate the effectiveness of the Airtraq and CTrach with 86 patients of ASA I and ASA II.The mean time to see glottis was shorter withAirtraq than CTrach(11.9vs37.6s,respectively;p<0.001.The mean time taken for tracheal intubation was also shorter with the Airtraq than CTrach 25.6 and 66.3 sec;p<0.001.There was less mucosal damage with the Airtraq.

A study was conducted titled "The learning curve for laryngoscopy: Airtraq versus Macintosh laryngoscopes.In this study ten medical students with no prior experience in airway management were recruited and underwent training in Macintosh and Airtraq laryngoscopy. The mean success rates for the procedures were 86% for Airtraq and 64%for Macintosh laryngoscope. Even students achieved success rates>90% using Airtraq versus one using the Macintosh(p=0.002).[3]

A study titled "Cervical spine movement during intubation using the Airtraq and direct laryngoscopy" was conducted. In this study 33 patients without cervical problems were enrolled .The patients were randomized into direct laryngoscope and the Airtraq groups.The duration of intubation was significantly longer in the Airtraq group with a conclusion that , Airtraq was not recommended as an alternative to the direct laryngoscopy in cervical spine injuries.[4]

In a study titled "Comparison of the Airtraq and the Macintosh laryngoscope for double-lumen tube intubation" 60patients were intubated by anesthesiologist with either Airtraq(n=30) or a Macintosh laryngoscope(n=30).The mean time needed for correct intubation was 20+/-16 Sec in Airtraq and 17.5+/-10sec in Macintosh group(p=0.86).The Cormack and Lehane grade was I in all 30 patients in the Airtraq group and in the Macintosh group it was I and II in 17 and 13 patients. The incidence of hoarseness was significantly higher in Airtraq group 24h post operatively(p=0.01),with a conclusion that Airtraq device did not result in superior patient safety in this setting.[5]

A study titled “Effect of cervical spine immobilization technique and laryngoscope blade selection on unstable cervical spine in a Cadaver model of intubation” was conducted. In this study a random crossover trial evaluated the effect of manual in line stabilization and 3 different laryngoscope blades on cervical movement during OTI in cadaver of cervical spine injury.The manual in line stabilization resulted in significantly less movement than cervical collar immobilization during OTI with regard to antero-posterior displacement. The Cormack-Lehane grade was significantly better with manual in line stabilization versus cervical collar immobilization; No differences were observed with blades.The conclusion was manual in line stabilization resulted in less cervical subluxation and better vocal cord visualization. The Miller straight blade allowed less axial distraction than the Macintosh or Mc Coy blades.[6]

A study was conducted titled “Comparison of the Macintosh, McCoy, Airtraq laryngoscopes and the intubating laryngeal mask airway in a difficult airway with manual in line stabilization”. A cross over, simulation based study by thirty five experienced physicians, performing tracheal intubation on a

Laerdal Sim Man manikin in both normal airway and difficult airway scenario with MILS with devices like Macintosh, McCoy, Airtraq and ILMA. The primary outcome was time of intubation. The McCoy demonstrated multiple advantages over Macintosh. The Airtraq was associated with a longer time for intubation than the Macintosh, McCoy and iLMA , 39.3,26.7,23.3,39.3,22.8s, respectively ($p<0.0001$). The Airtraq delivered the best glottic view and lowest force of intubation in both.

MATERIALS AND METHODS

Design of study : prospective, randomized, single blinded study

Study population: Cases posted for cervical spine surgeries.

INCLUSION CRITERIA:

Elective surgeries under general anaesthesia

Both sexes

Age :18-60 years

ASA I& II

EXCLUSION CRITERIA:

Mento – hyoid distance <3cm

Thyro – mental distance <5cm

Sterno – mental distance <10cm

Neck circumference >42cm

Patients with pulmonary aspiration of gastric contents

Pregnancy

Airway distortion

Mouth opening <2 finger

METHODOLOGY

Patients scheduled for cervical spine surgery under general anaethesia were eligible for the study. 60 patients were randomized into two groups. Patients are pre oxygenated with 100% oxygen for 3 minutes. Patients were given fentanyl 1-1.5ug/kg & glycopyrrolate 5u/kg, induced with thiopentone 5mg/kg, ventilated with sevoflurane 2.0-2.5% in oxygen and vecuronium 0.1mg/kg

1. Group A – AIRTRAQ Group.
2. Group M – Mc COY Group.

PARAMETERS MONITORED

- Difficulty of insertion with Mc COY or AIRTRAQ will be graded on Likert scale very difficult(-2), slightly difficult(-1), not difficulty(0), easy(+1), very easy(+2)
- Intubation time will be noted
- Laryngoscopic views will be graded with The Cormack – Lehane grading I-IV
- Episodes of failure of intubation will be noted
- Number of attempts will be noted
- Complication during intubation like airway trauma and episodes of de-saturation

- Post-operative complication like laryngospasm, sore throat will be noted
- Alternative procedures
- Intubation difficulty scale(IDS) score
- Position of vocal cords at intubation will be noted
- SpO2
- Heart rate, MABP will be noted

Statistical Tools:

The information collected regarding all the cases were recorded in a masterchart. Statistical analysis performed using SPSS version 13. Continuous data were presented as mean±SD, ordinal data as median with inter quartile range (IQR), and categorical data were presented asfrequency andproportions. Categorical data were compared between Airtraq and Mc Coy laryngoscope using Chi‑square test. Ordered categorical data like IDS score were compared using Wilcoxon Signed ranked test and continuous data compared using paired sample *t*‑test. The significance level for all analyses set as $P<0.05$.

OBSERVATION AND RESULTS

Table 1: Age distribution

Age	Mean	SD	P. value
McCoy	40.87	8.67	0.496
Airtraq	39.67	7.08	

Age distribution between Airtraq & Mc-Coy group was statistically not significant

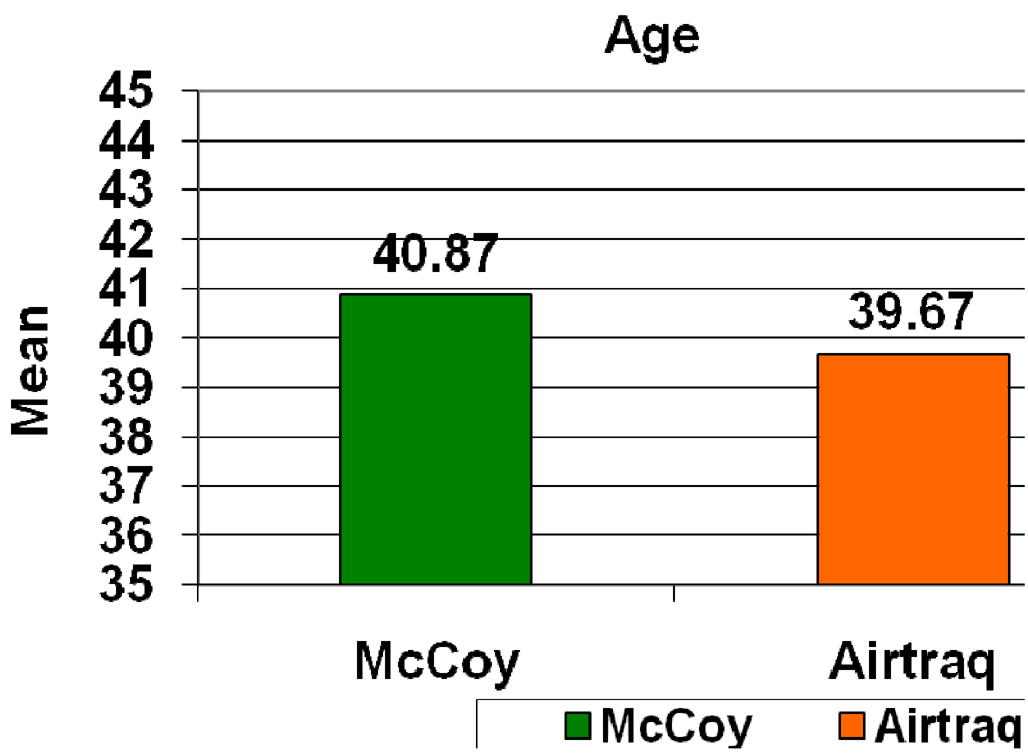


Table 2: Sex Distribution

Sex	Male	Female
McCoy	24	6
Airtraq	22	8
p value	0.947 Not significant	

Sex distribution was not statistically significant.

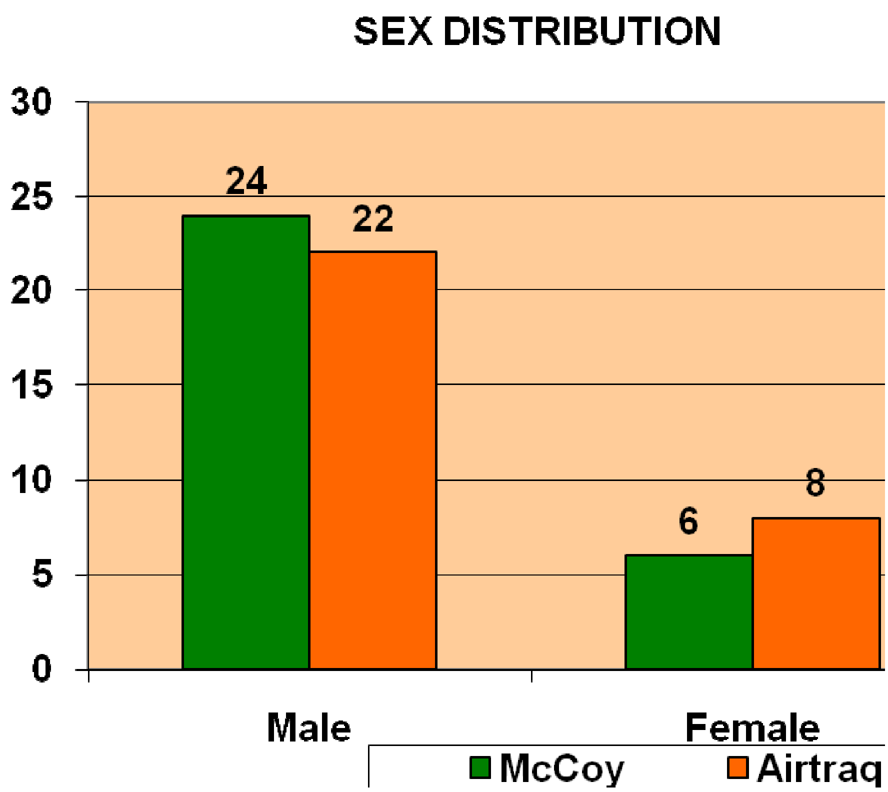


Table 3: weight

Weight	Mean	SD	p value
McCoy	62.5	9.45	0.87
Airtraq	62.9	9.45	0.84

Weight distribution was statistically not significant.

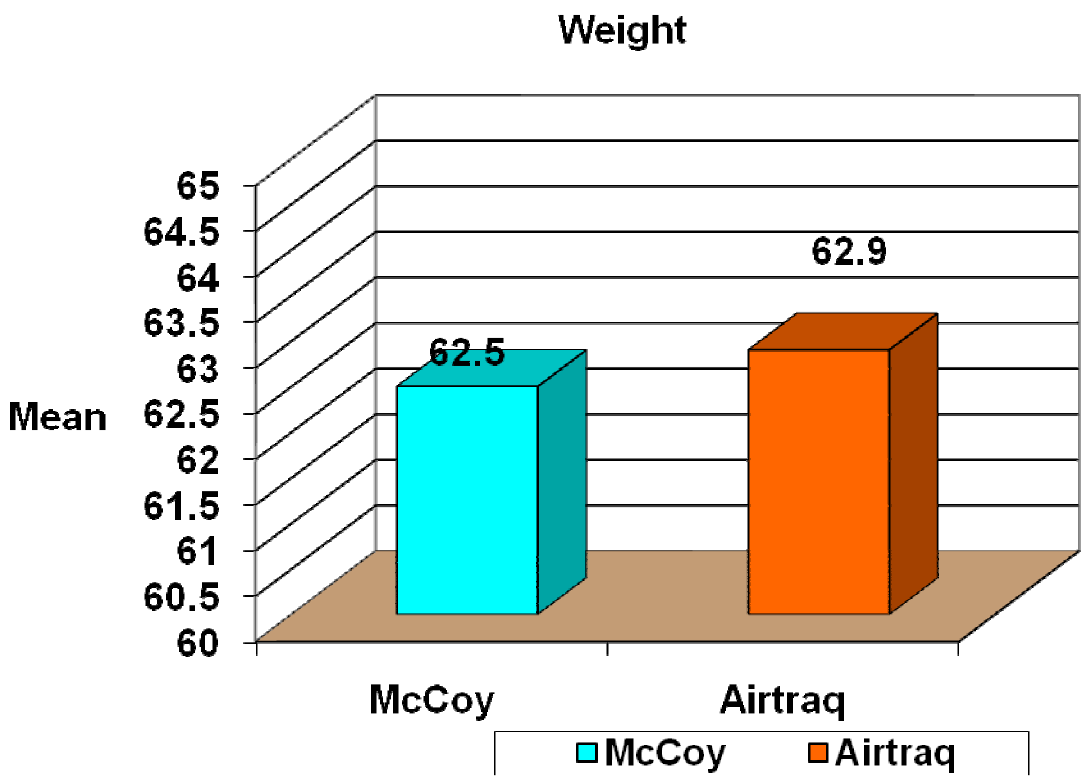


Table 4 Intubation Time:

Intubation time(secs)	Mean	SD	pvalue
McCoy	35.37	0.81	
Airtraq	29.6	0.89	<0.001

P value <0.001.intubation time between Mc-Coy & Airtraq groups was statistically significant.

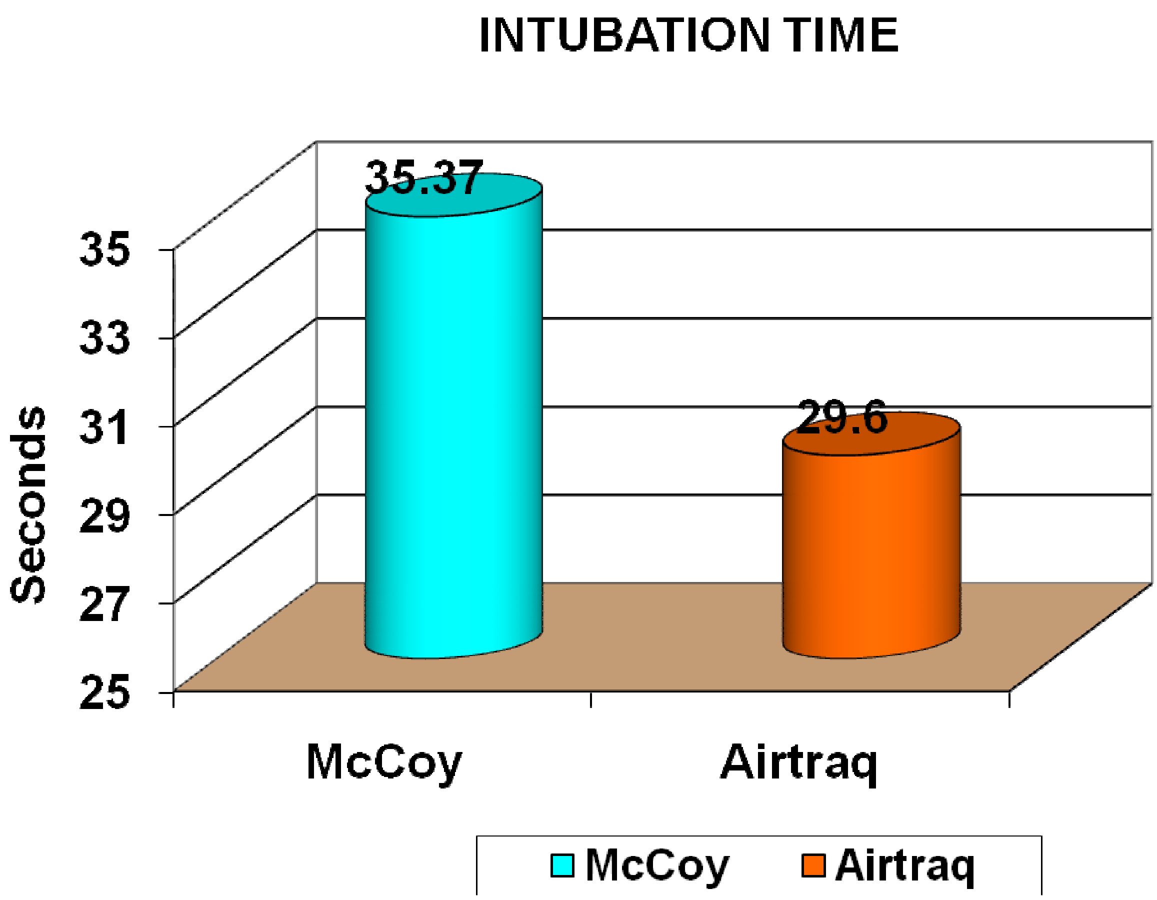


Table 5:Intubation difficulty score

IDS	McCoy	Airtraq
0 - 1	0	30
2 - 3	0	0
4 - 6	30	0

P value < 0.001 significant

IDS score between Airtaq & McCoy was statistically significant.

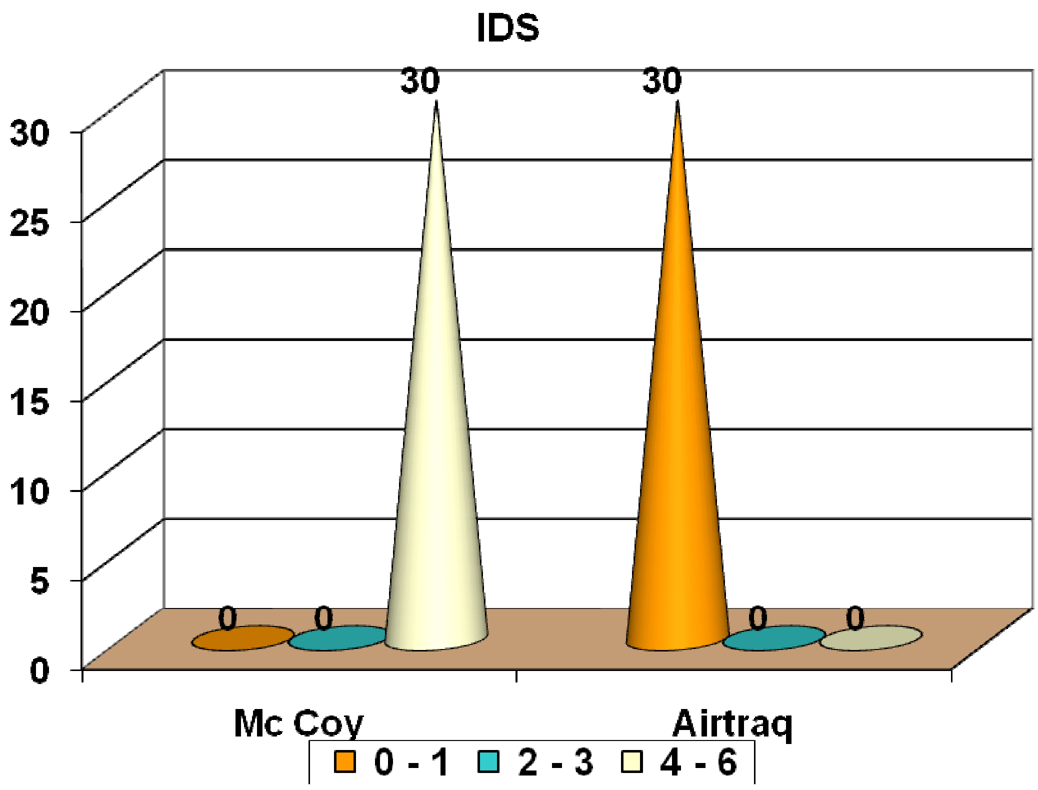


Table 6:No. of attempts

No.of attempts	McCoy	Airtraq	pvalue
1 time	22	27	<0.001
2 time	8	3	

No: of attempts between Airtraq & McCoy was statistically significant

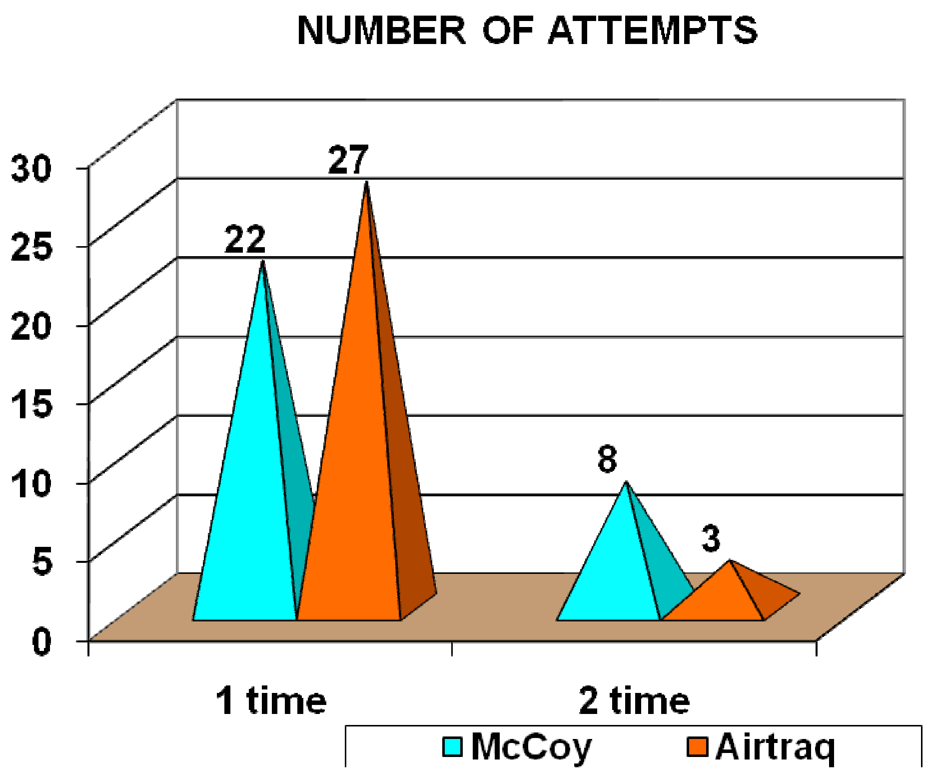


Table 7: Cormack & Lehane view(CL)

CL	McCoy	Airtraq
1	0	25
2	8	5
3	18	0
4	4	0

P vaiue < 0.001 significant

CL glottic view between Airtraq & McCoy was statistically significant

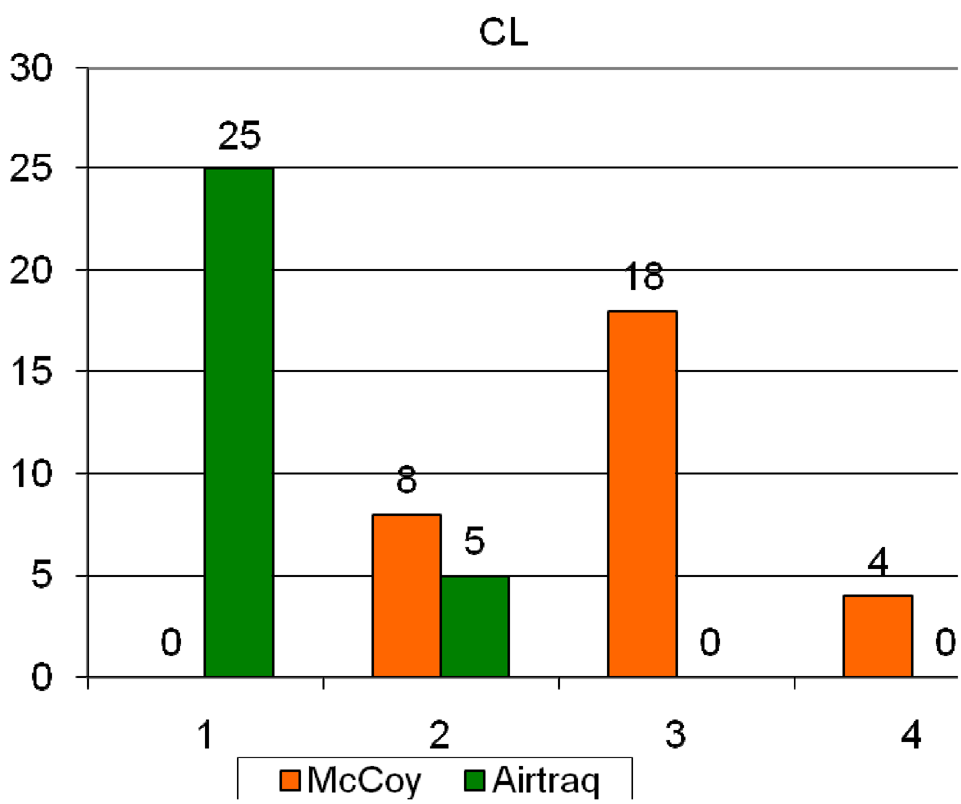


Table 8 :Alternate procedure

Alternate procedure	McCoy	Airtraq
Bougie	22	4
Hinge	8	0

In McCoy bougie used in 22 cases where as 4 cases in Airtraq group.

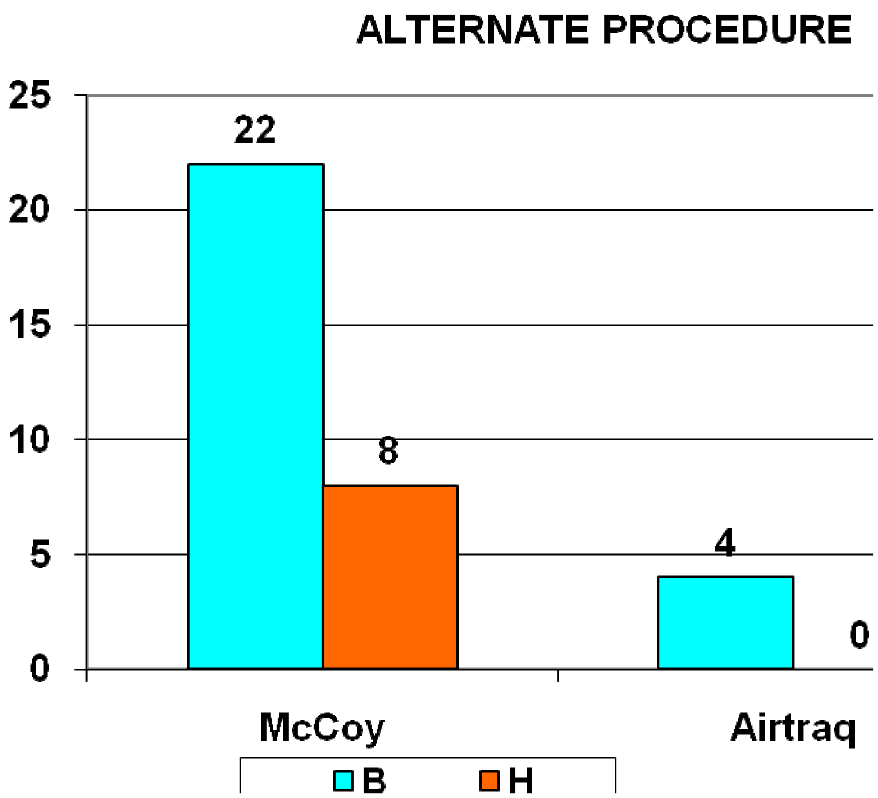


Table 9:External pressure

External pressure	McCoy	Airtraq
Yes	22	0
No	8	30

External pressure applied in 22 cases in McCoy group where as none in Airtraq group.

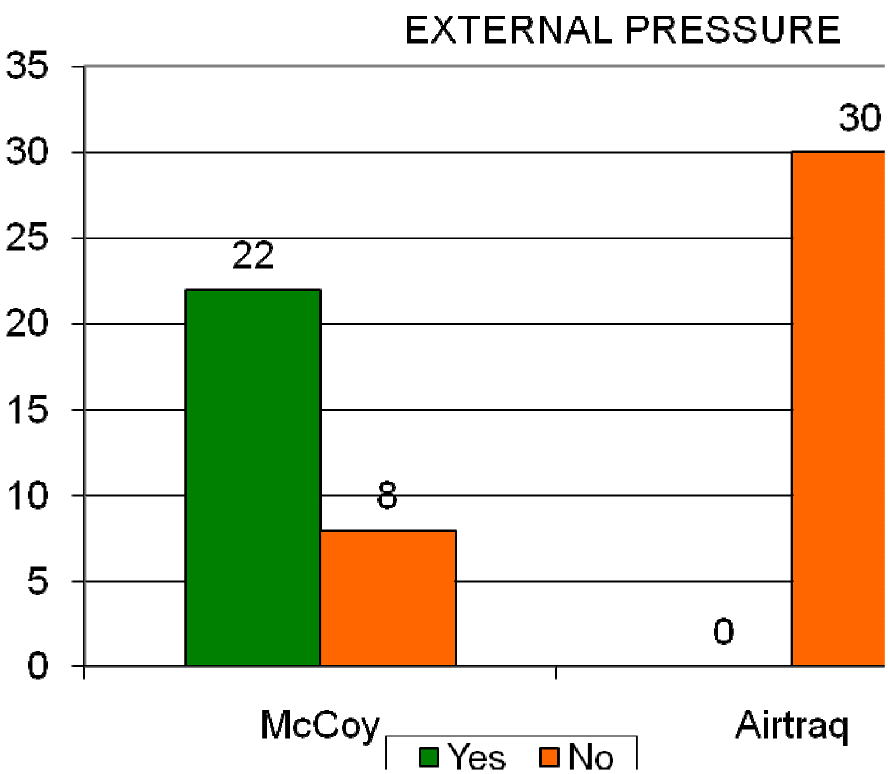


Table 10:Airway trauma

Airway Trauma	McCoy	Airtraq
Yes	4	1
No	26	29

Airway trauma was noted in 4 cases in McCoy group whereas only one case in Airtraq group

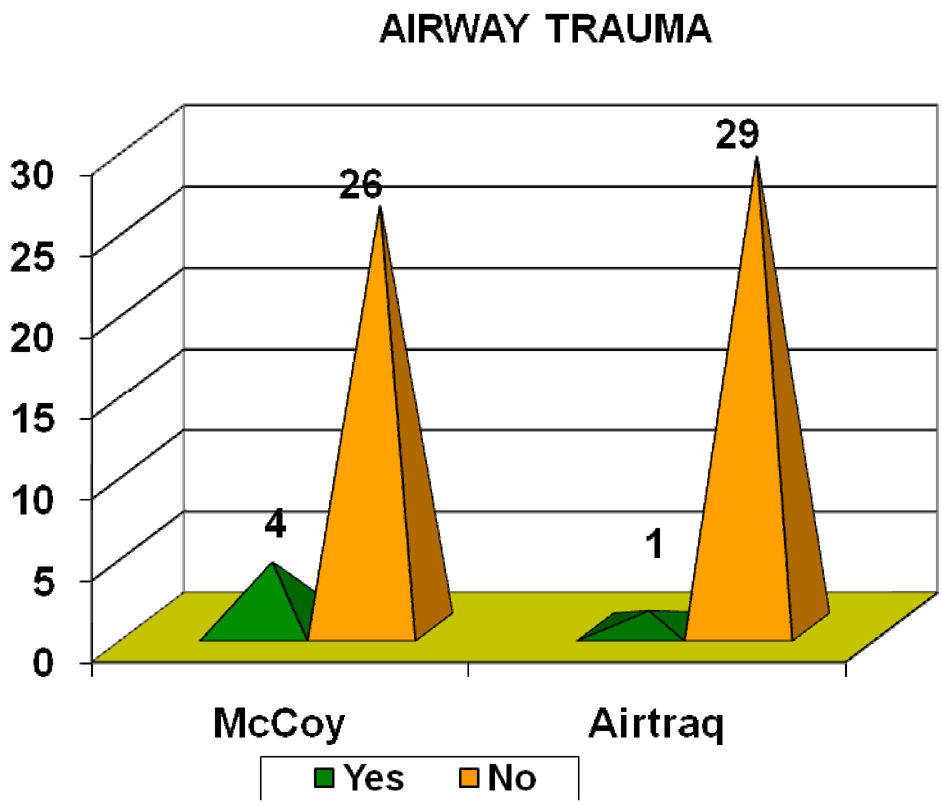


Table 11:Airway complications

Airway complication	McCoy	Airtraq
Yes	0	0
No	30	30

No airway complications were noted in both groups

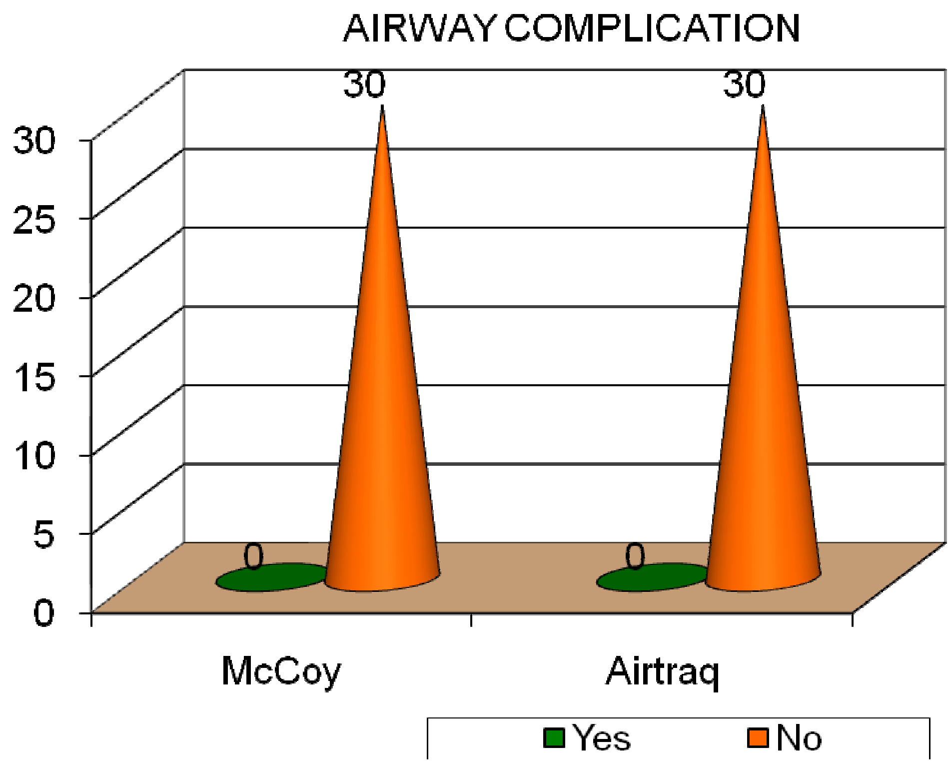


Table 12 :Failed intubation

Failed	McCoy	Airtraq
Yes	0	2
No	30	28

Failed intubation with Airtraq was noted in two cases.

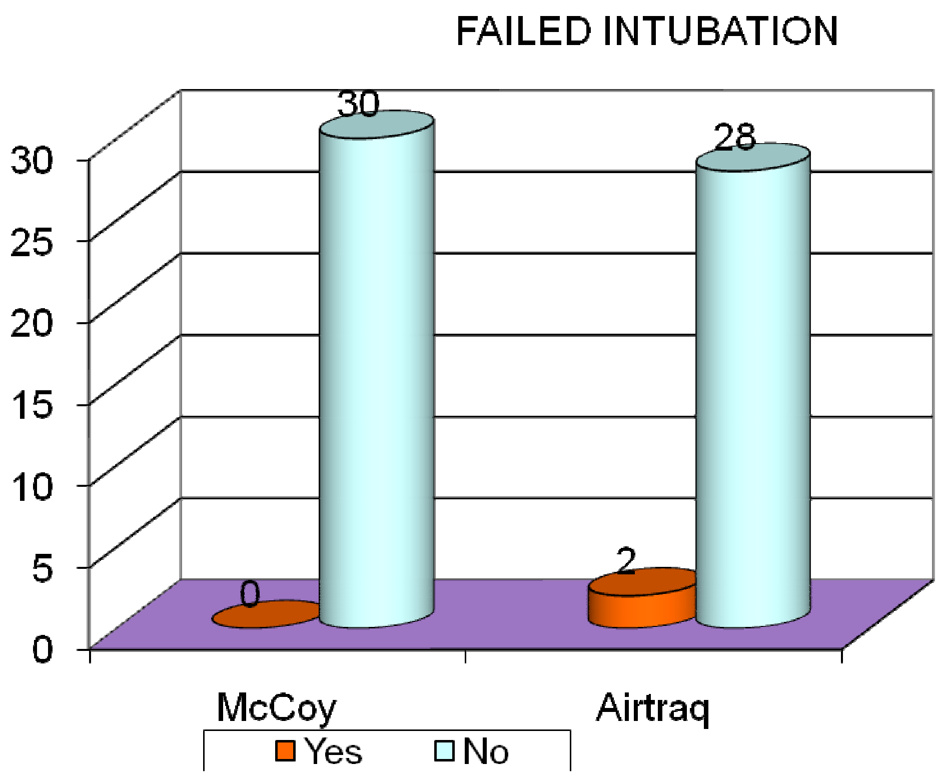


Table 13: Difficulty of insertion

	McCoy	Airtraq
Very Difficult	4	1
Slight Difficult	18	7
No Difficult	8	16
Easy	0	6

Very difficult insertion was noted in 4 cases in McCoy group whereas 1 case in Airtraq group, no difficult was noted in 8 cases in McCoy group wheras 16 cases in Airtraq group.

Difficult of insertion

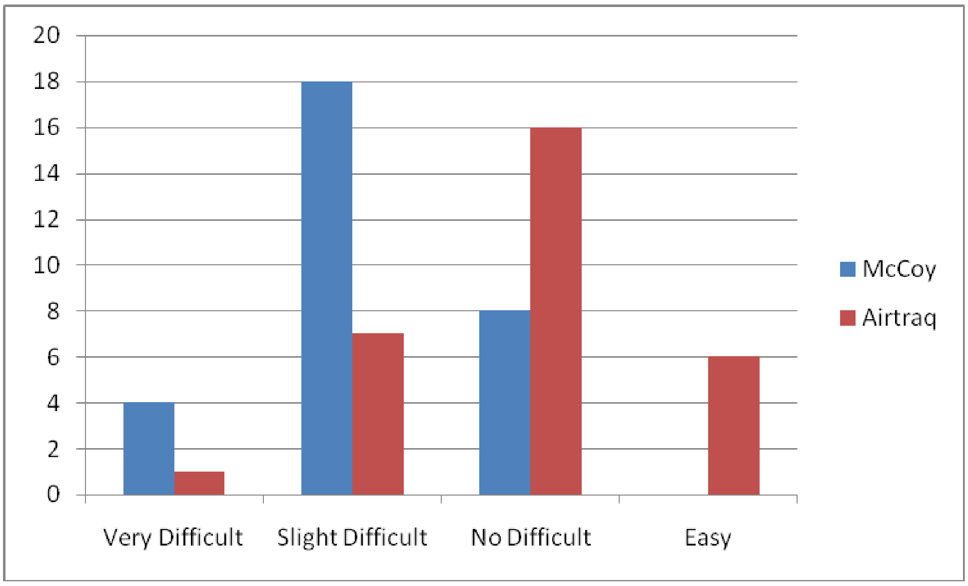


Table 14: Changes in Heart rate(mean)

Heart Rate	McCoy	Airtraq
	Mean	
Before Induction	82.13	81.67
Before Intubation	79.47	76.93
After Intubation	92.4	84.67
1 minute	97.87	80.6
3 minute	90	80.47
5 minute	84.33	78.33

There was significant difference in the Heart rate between McCoy & Airtraq noted at all periods.

Changes in Heart rate

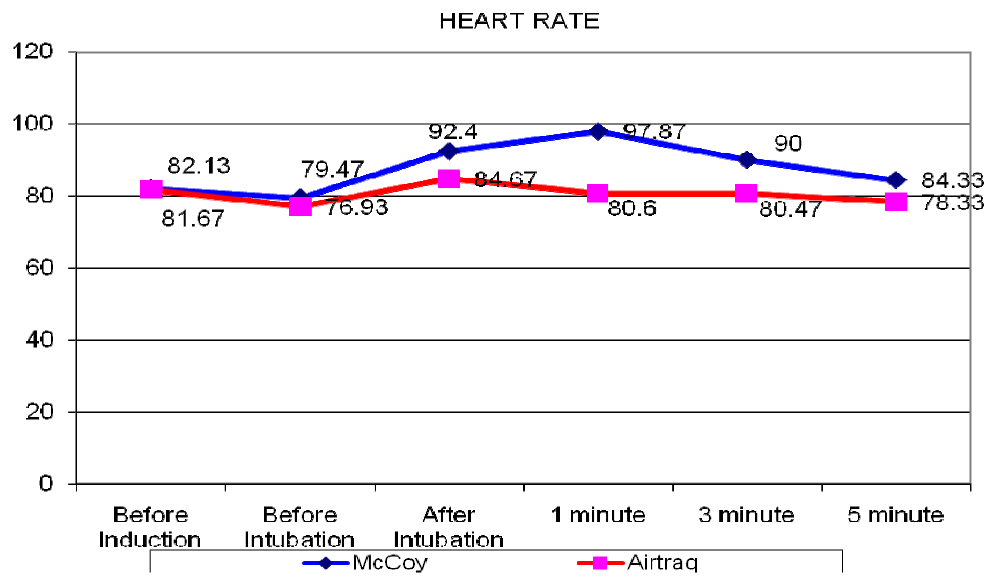


Table 15: Changes in Mean arterial pressure

MAP	McCoy	Airtraq
Before Induction	87.9	88.8
Before Intubation	89.3	85.3
After Intubation	95.1	91.5
1 minute	97.2	90.9
3 minute	94.0	90.7
5 minute	90.9	86.1

There was significant changes in MABP between McCoy & Airtraq group.

Changes in MABP

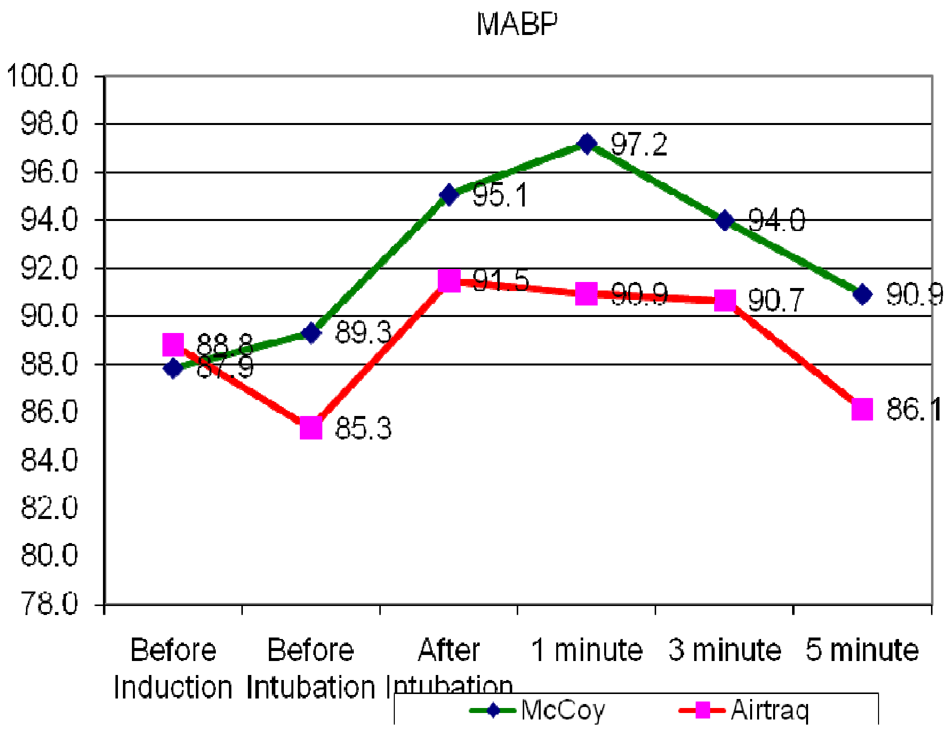
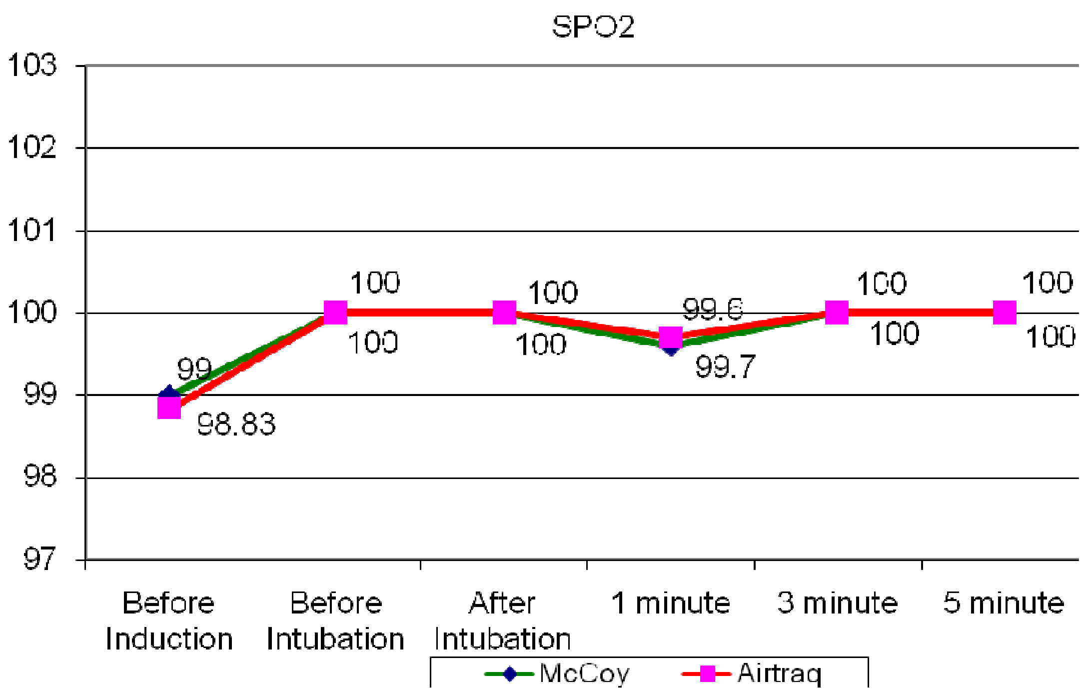


Table 16:Changes in SpO2

SPO2	McCoy	Airtraq
Before Induction	99	98.83
Before Intubation	100	100
After Intubation	100	100
1 minute	99.6	99.7
3 minute	100	100
5 minute	100	100

There was no significant changes in oxygen saturation noted between Airtraq & McCoy groups.

Changes in Spo2



DISCUSSION

In this study 60 patients were enrolled, divided in to two groups, 30 in each group. The result of this demonstrated that there was no statistically significant difference in age , sex and weight of the patients. No difficulty met during insertion of Airtraq or Mc-Coy laryngoscope. There were two failures encountered with Airtraq group , not related to poor view of vocal cords, but mainly due to an inability to advance then ET tube with in 120 sec . eight patients required second attempts with Mc-Coy laryngoscope, where as only three patients required second attempt in Airtraq group ($P < 0.001$). Airtraq reduced IDS score significantly and improved Cormack and Lehane glottis view. None of the patients had an IDS score of 1 or less with laryngoscopy using Mc-Coy blade, compared to 30 with the Airtraq. Using Mc-Coy blade 30 patients had an IDS score of 4 or greater, indicating moderate to severe intubation difficulty, where as none with Airtraq had an IDS> 4.The intubation time with Airtraq was 29.6 ± 0.89 secs where as with Mc-Coy laryngoscope was 35.37 ± 0.81secs ($P<0.001$) which shows there is a statistically significant difference. In Airtraq group Cormack and Lehane grade 1 was abserved in 25 cases, grade 2 was observed in 5 cases , where as CL grade >3 was observed in 22 cases ($P<0.001$) which shows statistically significant differernce. Regarding oxygen saturation during intubation in both groups , it was preserved above 96% and no desaturation was documented during the procedure. Maharaj et al documented statistically significant shorter time for intubation with Airtraq when compared to Mc-Coy. Hemodynamic changes were analysed in this study. There was significant increase in heart rate and MABP at all periods following intubation with Mc-Coy group. There was no complications encountered in both groups. Removal of cervical collar was not required in any of the patients with both the techniques.

SUMMARY

In this study, we evaluate the effectiveness of Airtraq optical laryngoscope in comparison with the Mc-Coy laryngoscope , when performing tracheal intubation in patients with cervical collar and manual in line axial stabilization. Sixty patients of ASA 1& 2 of either sex divided into two groups, thirty patients in each group.

Group A – AIRTRQ group

Group M –Mc-Coy group

The study was done at Govt. Rajaji hospital and Madurai Medical College between the period of 2013- 2014.

In our study group the age of the patients, sex distribution and weight are not statistically significant. There is significant increase in Heart rate and MABP in Mc-Coy group when compared to Airtraq group. Intubation time, IDS score, Cormack & Lehane glottic view were statistically significant in Airtraq group. Removal of cervical collar was not required in any of the patients with both the techniques.

CONCLUSION

Airtraq optical laryngoscope offers a new approach for the management of difficult airway in patients with cervical spine injury. It improves ease of intubation when compared with Mc-Coy laryngoscope in patients with cervical collar and MILS simulating cervical spine injury with the same rapidity and can aid intubation without the need to remove the cervical collar.

BIBLIOGRAPHY

1. Maharaj CH, O'Croinin D, Curley G, Harte BH, Laffey JG.A comparison of tracheal intubation using the Airtraq orthe Macintosh laryngoscope in routine airway management: A randomised, controlled clinical trial. Anaesthesia2006;61:1093‑9.
2. Maharaj CH, Costello JF, Harte BH, Laffey JG. Evaluation of the Airtraq and Macintosh laryngoscopes in patients at increased risk for difficult tracheal intubation. Anaesthesia2008;63:182‑8.
3. Schalte G, Scheid U, Rex S, Coburn M, Fiedler B, Rossaint R, *et al*. The use of the Airtraq(R) optical laryngoscope for routine tracheal intubation in high‑risk cardio‑surgical patients. BMC Res Notes 2011;4:425.
4. Koh JC, Lee JS, Lee YW, Chang CH. Comparison of the laryngeal view during intubation using Airtraq and Macintosh laryngoscopes in patients with cervical spine immobilization and mouth opening limitation. Korean JAnesthesiol2010;59:314‑8.
5. Dhonneur G, Abdi W, Amathieu R, Ndoko S, Tual L. Optimising tracheal intubation success rate using the Airtraq laryngoscope. Anaesthesia 2009;64:315‑9.
6. Su YC, Chen CC, Lee YK, Lee JY, Lin KJ. Comparison of video laryngoscopes with direct laryngoscopy for tracheal intubation: A meta‑analysis of randomised trials. Eur JAnaesthesiol 2011;28:788‑95.

7. Wetsch WA, Spelten O, Hellmich M, Carlitscheck M, Padosch SA, Lier H, *et al*. Comparison of different video laryngoscopes for emergency intubation in a standardized airway manikin with immobilized cervical spine by experienced anaesthetists. A randomized, controlled crossovertrial. Resuscitation 2012;83:740‑5.
8. Smith CE, Pinchak AB, Sidhu TS, Radesic BP, Pinchak AC, Hagen JF. Evaluation of tracheal intubation difficulty in patientswith cervical spine immobilization: Fiberoptic(WuScope) versus conventional laryngoscopy. Anesthesiology 1999;91:1253‑9
9. Turkstra TP, Pelz DM, Jones PM. Cervical spine motion: A fluoroscopic comparison of the Airtraq laryngoscope versus the Macintosh laryngoscope. Anesthesiology 2009;111:97‑101.
10. Fuchs G, Schwarz G, Baumgartner A, Kaltenbock F, Voit‑Augustin H, Plani W. Fiberoptic intubation in 327 neurosurgical patients with lesions of the cervical spine .J Neurosurg Anesthesiol 1999;11:11‑6.
11. Maharaj CH, Buckley E, Harte BH, Laffey JG. Endotracheal intubation in patients with cervical spine immobilization: A comparison of macintosh and airtraq laryngoscopes. Anesthesiology 2007;107:53‑9.
12. Maharaj CH, Higgins BD, Harte BH, Laffey JG. Evaluation of intubation using the Airtraq or Macintosh laryngoscope by anaesthetists in easy and

simulated difficult laryngoscopy–a manikin study. Anaesthesia 2006;61:469‑77.

13. Turkstra TP, Pelz DM, Jones PM. Cervical spine motion: A fluoroscopic comparison of the AirTraq Laryngoscope versus the Macintosh laryngoscope. Anesthesiology 2009;111:97‑101.

14. Arslan ZI, Yildiz T, Baykara ZN, Solak M, Toker K. Tracheal intubation in patients with rigid collar immobilisation of the cervical spine: A comparison of Airtraq and LMA CTrach devices. Anaesthesia 2009;64:1332‑6.

15. Norman G. Likert scales, levels of measurement and the “laws” of statistics. Adv Health Sci Educ Theory Pract 2010;15:625‑32.

16. Adnet F, Borron SW, Racine SX, Clemessy JL, Fournier JL, Plaisance P, *et al*. The intubation difficulty scale (IDS): Proposal and evaluation of a new score characterizing the complexity ofendotracheal intubation. Anesthesiology 1997;87:1290‑7.

STUDY PROFORMA

NAME :

I.P.NO :

ASA :

AGE & SEX :

WEIGHT :

DATE&TIME OF ADMISSION:

DIAGNOSIS :

PROCEDURE :

HISTORY :Allergy to drugs, CAD, DM, Hypertension.

CLINICAL EXAMINATION : PR,BP, SPO2, RS, CVS, CNS.

BASIC INVESTIGATIONS:

Complete Blood Count, Blood grouping & typing, BT, CT, Urine routine, Blood urea, RBS, Serum Creatinine, CXR-PA view, ECG, ECHO, Serum Electrolytes

ANAESTHETIC TECHNIQUE: All patients were given fentanyl 1-1.5ug/kg & glycopyrrolate 5ug/kg, induced with thiopentone 5mg/kg. All patients were ventilated with sevoflurane 2.0-2.5% in oxygen and vecuronium 0.1mg/kg.

GROUP A : Patients intubated using AIRTRAQ laryngoscope.
GROUP M : Patients intubated using McCoy laryngoscope.

VARIABLES	**AIRTRAQ**	**McCoy**
Intubation time		
No: of attempts		
Difficulty of insertion		
External pressure		
Alternate procedure		
Glottic exposure(CL)		
Failed intubation		
Airway trauma		
Airway complications		
Heart rate		
MABP		
SpO_2		

MASTER CHART - AIRTAQ GROUP

S. No	Name	Age	Sex	ip No	Weight	Intubation Time	IDS	No: of Attends	No: of Operations	CL	Alteration Procedure	Vocal - position	External Pressure	Air way Trauma	Air way coplications	Failed	Very Difficult	Slight Difficult	No Difficult	Easy
1	vasu	32	M	30466	62	29	0	1	1	1		Abducted	No	No	No	No			Y	
2	jeya kumar	24	M	58350	64	29	0	1	1	1		Abducted	No	No	No	No			Y	
3	ramamoorthi	36	M	58851	66	29	0	1	1	1		Abducted	No	No	No	No				Y
4	sundaram	44	M	48792	58	29	0	1	1	1		Abducted	No	No	No	No			Y	
5	dharmar	42	M	50422	68	30	0	1	1	1		Abducted	No	No	No	No			Y	
6	saravanan	48	M	551	62	30	1	2	1	2	B	Abducted	No	No	No	No		Yes		
7	palpandi	34	M	63097	66	31	0	1	1	1		Abducted	No	No	No	No			Y	
8	pappathi	44	F	60077	54	31	0	1	1	1		Abducted	No	No	No	No				Y
9	kannan	46	M	64003	62	29	0	1	1	1		Abducted	No	No	No	No			Y	
10	perumal	52	M	31466	68	29	1	1	1	2	B	Abducted	No	Yes	No	Yes	Yes			
11	alagar	38	M	51548	70	29	0	1	1	1		Abducted	No	No	No	No			Y	
12	thangam	36	F	46489	48	28	0	1	1	1		Abducted	No	No	No	No			Y	
13	palanisamy	32	M	61278	65	31	0	1	1	1		Abducted	No	No	No	No		Yes		
14	kalabi	28	M	2756	68	30	0	1	1	1		Abducted	No	No	No	No				Y
15	mariammal	44	F	3466	52	30	0	1	1	1		Abducted	No	No	No	No			Y	
16	selvam	46	M	1334	72	30	0	1	1	1		Abducted	No	No	No	No			Y	
17	suresh	48	M	4881	68	30	0	1	1	2		Abducted	No	No	No	No		Yes		
18	kaleeshwari	52	F	4998	52	31	0	1	1	1		Abducted	No	No	No	No			Y	
19	jayaraman	34	M	6073	68	28	0	1	1	1		Abducted	No	No	No	No				Y
20	selvi	36	F	8183	48	29	0	1	1	1		Abducted	No	No	No	No			Y	
21	vignesh	38	M	10710	68	29	1	2	1	2	B	Abducted	No	No	No	Yes		Yes		
22	shenbagam	40	F	9786	48	29	0	1	1	1		Abducted	No	No	No	No			Y	
23	deva pandiyan	42	M	8873	66	31	0	1	1	1		Abducted	No	No	No	No				Y
24	vasuki	41	F	7556	46	31	0	1	1	1		Abducted	No	No	No	No			Y	
25	senthil	51	M	14368	72	30	1	2	1	2	B	Abducted	No	No	No	No			Y	
26	vijayakumar	33	M	13326	74	30	0	1	1	1		Abducted	No	No	No	No		Yes		
27	ganesan	37	M	14838	76	29	0	1	1	1		Abducted	No	No	No	No				Y
28	amutha	38	F	14382	46	29	0	1	1	1		Abducted	No	No	No	No		Yes		
29	periyasamy	32	M	15077	78	29	0	1	1	1		Abducted	No	No	No	No			Y	
30	kumaresan	36	M	16812	72	29	0	1	1	1		Abducted	No	No	No	No		Yes		

MASTER CHART - McCOY GROUP

S. No	Name	Age	Sex	ip No	weight	Intu bation Time	IDS	No: of Atte mpts	No: of Opera tions	CL	Alteration Procedure	Vocal Card position	External Pressure	Air way Trauma	Air way coplicatio ns	Failed	Very Dific ult	Slight Diffic ult	No Diffi cult	Easy
1	eshwaran	44	M	457-	62	35	4	1	1	3	H	Abducted	No	No	No	No			Yes	
2	akshmanan	42	M	45897	66	36	4	1	1	3	B	Abducted	Yes	No	No	No		Yes		
3	malaisamy	46	M	48733	68	35	4	1	1	3	B	Abducted	Yes	No	No	No		Yes		
4	mohan	38	M	39156	58	36	5	2	1	3	B	Abducted	Yes	No	No	No		Yes		
5	santhakumar	24	M	37165	55	36	4	1	1	2	H	Abducted	No	Yes	No	No			Yes	
6	vellaiammal	28	F	34855	46	35	4	1	1	3	H	Abducted	No	No	No	No			Yes	
7	sundaramoorthy	42	M	4230	58	37	6	2	1	4	B	Abducted	Yes	No	No	No	Yes			
8	baskaran	52	M	46321	60	36	4	1	1	3	B	Abducted	Yes	No	No	No		Yes		
9	muruganantham	58	M	36590	68	35	5	2	1	2	B	Abducted	Yes	Yes	No	No		Yes		
10	raheem	56	M	45745	72	37	4	1	1	3	B	Abducted	Yes	No	No	No		Yes		
11	aandi	24	M	39283	74	35	6	2	1	4	B	Abducted	Yes	No	No	No	Yes			
12	azhagu	26	F	45348	42	35	4	1	1	3	B	Abducted	Yes	No	No	No		Yes		
13	manikandan	38	M	42661	76	36	5	2	1	2	B	Abducted	Yes	No	No	No		Yes		
14	jeyaprakash	36	M	44599	78	35	4	1	1	3	B	Abducted	Yes	No	No	No		Yes		
15	rajapandi	46	M	43635	68	35	4	1	1	2	H	Abducted	No	No	No	No			Yes	
16	lakshmi	42	F	48548	48	35	4	1	1	2	B	Abducted	Yes	No	No	No		Yes		
17	velusamy	44	M	39167	64	35	4	1	1	3	H	Abducted	No	No	No	No			Yes	
18	sivalingam	41	M	460	66	34	4	1	1	3	B	Abducted	Yes	No	No	No		Yes		
19	mani	31	M	42603	67	35	5	1	1	2	B	Abducted	Yes	No	No	No		Yes		
20	vaiyammaal	36	F	46909	52	36	6	2	1	4	B	Abducted	Yes	Yes	No	No	Yes			
21	durairaj	37	M	39138	68	37	4	1	1	3	B	Abducted	Yes	No	No	No		Yes		
22	venkatesh	43	M	46877	70	35	4	1	1	3	B	Abducted	Yes	No	No	No		Yes		
23	mookandi	54	M	44945	71	36	5	2	1	3	B	Abducted	Yes	No	No	No		Yes		
24	eshwari	38	F	48733	48	34	4	1	1	2	B	Abducted	Yes	No	No	No		Yes	Yes	
25	boominathan	41	M	44982	68	35	4	1	1	3	H	Abducted	No	No	No	No				
26	muthumani	46	M	52351	66	34	6	2	1	4	B	Abducted	Yes	Yes	No	No	Yes			
27	nandhini	35	F	44018	46	35	4	1	1	3	B	Abducted	Yes	No	No	No		Yes	Yes	
28	kubendran	47	M	48332	62	35	4	1	1	3	H	Abducted	No	No	No	No				
29	ramasamy	45	M	45531	64	36	4	1	1	2	B	Abducted	Yes	No	No	No		Yes	Yes	
30	johnpeter	46	M	48506	64	35	4	1	1	3	H	Abducted	No	No	No	No				

turnitin

Digital Receipt

This receipt acknowledges that Turnitin received your paper. Below you will find the receipt information regarding your submission.

The first page of your submissions is displayed below.

Submission author:	201320118-md (anaesthesiology) Dr...
Assignment title:	TNMGRMU EXAMINATIONS
Submission title:	Comparision of tracheal intubation us...
File name:	fair_copy.docx
File size:	11.36M
Page count:	108
Word count:	12,648
Character count:	71,353
Submission date:	20-Sep-2014 12:09AM
Submission ID:	452833289

INTRODUCTION

"It is a significant challenge even to the most experienced anaesthesiologist to intubate patients in whom the movement of the cervical spine is not desirable or restricted. In cases of cervical spine immobility or instability, the use of direct laryngoscopy is reserved: it requires flexion of the cervical spine and atlanto-occipital extension for alignment of the oral, pharyngeal and laryngeal axis to create a direct line of vision from the mouth to the vocal cords. Tracheal intubation in patients with suspected neck injuries should achieve two contradicting goals: sufficient laryngeal exposure and the least cervical spine movement." "As the former involves movement of the cervical vertebrae, intubation has to be performed using cervical spine immobilisation to prevent exacerbation of spinal cord injuries. Protective measures to avoid deleterious compression forces on the spinal column include application of rigid collar, a forehead tape and manual-in-line stabilisation (MILS)". "Cervical collar application reduce cervical spine movements, obstruct tracheal intubation with conventional laryngoscopy. The cervical collar also significantly reduces the mouth opening, rendering laryngoscopy difficult. Besides, the neck collar lifts up the chin and tips the larynx anteriorly'. "Removing the anterior portion of the collar can facilitate tracheal intubation. This jeopardise the safety of the cervical spine. MILS that is recommended for cervical spine immobilisation further impairs glottic visualization".

Turnitin Document Viewer - Internet Explorer

https://www.turnitin.com/dv?s=1&o=452833289&u=1031907949&student_user=1&lang=en_us&

The Tamil Nadu Dr.M.G.R.Medical... TNMGRMU EXAMINATIONS - DUE 15-...

Originality GradeMark PeerMark

Comparision of tracheal intubation using airtraq and Mc Coy laryngoscope in the

BY 201320118-MD (ANAESTHESIOLOGY) DR. SATHEESH P

turnitin 7% SIMILAR -- OUT OF 0

INTRODUCTION

"It is a significant challenge even to the most experienced anaesthesiologist to intubate patients in whom the movement of the cervical spine is not desirable or restricted. In cases of cervical spine immobility or instability, the use of direct laryngoscopy is reserved: it requires flexion of the cervical spine and atlanto-occipital extension for alignment of the oral, pharyngeal and laryngeal axis to create a direct line of vision from the mouth to the vocal cords. Tracheal intubation in patients with suspected neck injuries should achieve two contradicting goals: sufficient laryngeal exposure and the least cervical spine movement." "As the former involves movement of the cervical vertebrae, intubation has to be performed using cervical spine immobilisation to prevent exacerbation of spinal cord injuries. Protective measures to avoid deleterious compression forces on the spinal column include application of rigid collar, a

Match Overview

1	www16.us.archive.org	Internet source	3%
2	Brendan T. Finucane. "...	Publication	1%
3	bja.oxfordjournals.org	Internet source	<1%
4	Pearce, A.. "Evaluation...	Publication	<1%
5	&NA;, . "Abstracts of th...	Publication	<1%
6	ijaweb.org	Internet source	<1%
7	Brendan T. Finucane. "...	Publication	<1%
8	C. H. Maharaj. "Evaluat...	Publication	<1%

PAGE: 1 OF 108

Text-Only Report

Ref. No1864/E4/2/2014,

Govt. Rajaji Hospital,
Madurai.20. Dated: 29.03.2014

Institutional Review Board / Independent Ethics Committee.
Capt. Dr.B. Santhakumar, M.D., (F.M.,) deanmdu@gmail.com
Dean, Madurai Medical College &
Govt Rajaji Hospital, Madurai 625020. **Convenor**

Sub: Establishment-Govt. Rajaji Hospital, Madurai-20-
Ethics committee-Meeting Minutes- for March 2014
Approved list - Regarding.

The Ethics Committee meeting of the Govt. Rajaji Hospital, Madurai was held on 05.03.2014, Wednesday at 10.00 am to 12.00.noon at the Auditorium, Govt. Rajaji Hospital, Madurai. The following members of the committee have attended the meeting.

1.Dr.V. Nagarajan, M.D., D.M (Neuro) Ph: 0452-2629629 Cell.No 9843052029 nag9999@gmail.com	Professor of Neurology (Retired) D.No.72, Vakkil New Street, Simmakkal, Madurai -1	Chairman
2. Dr.Mohan Prasad , M.S M.Ch Cell.No.9843050822 (Oncology) drbkcmp@gmail.com	Professor & H.O.D of Surgical Oncology(Retired) D.No.32, West Avani Moola Street, Madurai -1	Member Secretary
3. Dr. Parameswari M.D (Pharmacology) Cell.No.9994026056 drparameswari@yahoo.com	Director of Pharmacology Madurai Medical College	Member
4. Dr.S. Vadivel Murugan, MD., (Gen.Medicine) Cell.No 9566543048 svadivelmurugan_2007@rediffmail.com	Professor& H.O.D of Medicine Madurai Medical College	Member
5. Dr.S. Meenakshi Sundaram, MS (Gen.Surgery) Cell.No 9842138031 drsundarms@gmail.com	Professor & H.O.D of Surgery Madurai Medical College	Member
6. Mrs. Mercy Immaculate Rubalatha, M.A., Med., Cell. No. 9367792650 lathadevadoss86@gmail.com	50/5, Corporation Officer's quarters, Gandhi Museum Road, Thamukam, Madurai-20	Member
7. Thiru..Pala. .Ramasamy , BA.,B.L., Cell.No 9842165127 palaramasamy2011@gmail.com	Advocate, D.No.72.Palam Station Road, Sellur, Madurai -2	Member
8. Thiru. P.K.M. Chelliah ,B.A Cell.No 9894349599 pkmandco@gmail.com	Businessman, 21 Jawahar Street, Gandhi Nagar, Madurai-20	Member

The following Projects was approved by the committee.

Name of P.G.	Course	Name of the Project	Remarks
Dr.P. Satheesh satheeshberry@gmail.com	PG in MD (Anaesthesiology), Madurai Medical College and Government Rajaji Hospital, Madurai	Comparison of Tracheal intubation using the airtraq and Mc Coy laryncoscope in the presence of rigid cervical collar simulating cervical immobilisation for traumatic cervical spine injury.	Approved

Please note that the investigator should adhere the following: She/He should get a detailed informed consent from the patients/participants and maintain it Confidentiaily.

1. She/He should carry out the work without detrimental to regular activities as well as without extra expenditure to the institution or to Government.
2. She/He should inform the institution Ethical Committee, in case of any change of study procedure, site and investigation or guide.
3. She/He should not deviate the area of the work for which applied for Ethical clearance. She/He should inform the IEC immediately, in case of any adverse events or Serious adverse reactions.
4. She/He should abide to the rules and regulations of the institution.
5. She/He should complete the work within the specific period and if any Extension of time is required He/She should apply for permission again and do the work.
6. She/He should submit the summary of the work to the Ethical Committee on Completion of the work.
7. She/He should not claim any funds from the institution while doing the work or on completion.
8. She/He should understand that the members of IEC have the right to monitor the work with prior intimation.

Member Secretary Chairman
Ethical Committee

29.3.14
DEAN/Convenor
Govt. Rajaji Hospital,
Madurai- 20.

To
The above Applicant
-thro. Head of the Department concerned

19/3/14

Forwarded
Dr. P. Satheesh

DIRECTOR
INSTITUTE OF ANAESTHESIOLOGY
Madurai Medical College &
Govt. Rajaji Hospital
Madurai-625 020